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Admiral Dewey on our Merchant Marine.

Office of the Admiral, 1747 Rhode Island Avenue, Washington, Nov. 21, 1899.

Dear Sir:

Replying to your letter of the 20th instant, I have much pleasure in expressing to you my belief that the upbuilding and strengthening of the merchant marine will have a very beneficial effect upon the country at large and tend to promote its prosperity. I hope to see everything done that can be done toward the growth and re-establishment of the merchant marine.

Yours very truly,

(Signed) GEORGE DEWEY.

CONTRACTS FOR CRUISERS.

BOARD OF NAVAL CONSTRUCTION NAMES FIRMS THAT WILL BUILD SIX SHIPS OF THE DENVER CLASS—KIND OF FIGHTERS INVOLVED IN THE NEW PROGRAMME FOR EIGHTEEN VESSELS—SUBMARINE BOATS —OTHER WASHINGTON MATTERS.

WASHINGTON BUREAU, MARINE REVIEW, 1345 PENNSYLVANIA AVENUE, WASHINGTON, D. C., NOVEMBER 22, 1899.

The board of naval construction has recommended that contracts for the construction of the six protected cruisers, provided for at the last session of congress, be awarded, one each, to the following firms: Wm. R. Trigg Co., Richmond, Va., $1,027,000; Lewis Nixon, Elizabethport, N. J., $1,039,996; Bath Iron Works, Bath, Me., $1,041,650; Union Iron Works, San Francisco, $1,041,900; Fore River Engine Co., Weymouth, Mass., $1,065,000; Neafie & Levy Ship & Engine Building Co., Philadelphia, $1,080,000, making the total cost of the six ships $6,295,516.

The vessels are to be constructed according to the plans prepared by the navy department. The firm of Townsend & Downey was the lowest bidder but they get no contract, as the special board reported that they were reliable though not fully equipped for the work. The board was practically unanimous upon having the cruisers constructed according to the department designs, though there was some discussion upon the subject of permitting the Trigg company to construct an 18-knot cruiser after their own plans.

The report of the board as regards ships for which appropriations will be asked from the next congress recommends the construction of three sheathed, armored and coppered cruisers of about 13,000 tons trial displacement, carrying the heaviest armor and most powerful ordnance for vessels of their class and to have the highest practicable speed and great radius of action; three sheathed and coppered cruisers of about 8,000 tons displacement, to have the highest practicable speed and great radius of action and to carry the most powerful ordnance suitable for vessels of their class; six sheathed and coppered gunboats of about 1,000 tons displacement and six sheathed and coppered gunboats of about 800 tons displacement, of light draught and carrying the most powerful ordnance for vessels of their class. The board is of the opinion that the present position of the United States necessitates the creation of a strong naval force which will be able to support any stand that may be taken in naval affairs.

The report of the board of inspection and survey and Chief Engineer Lowe is to the effect that the Holland submarine boat is a success. The chief engineer recommends the purchase of the Holland and says that it would be a good idea not to let the secret of the boat's construction get out of the United States. Chief Engineer Lowe's report is of a very enthusiastic kind. "I report my belief," he says, "that the Holland is a successful and veritable submarine torpedo boat capable of making an attack upon an enemy, unseen and undetectable, and that therefore she is an engine of warfare of terrible potency which the government must necessarily adopt into its service. Notwithstanding the Hague conference, the time has not arrived for nations to disarm. On the contrary that nation which is not ready to fight, that ceases to study war, that ceases to use the most frightful warlike appliances when war is made, has already placed itself in a position of inferiority and has ceased to possess those valuable attributes which are well described in the term manhood. Such a nation is already in the position of China, a prey to the weakest and the most rapacious and a disturbance to all the rest of mankind. If there is anything valuable in submarine warfare we must not permit our hands to be tied behind our backs by any Hague conference or pusillanimous humanitarianism forbidding such appliance."

The report continues at considerable length along the strong lines above quoted; refers to our dependencies in the Philippines and Hawaii; to the need of fifty submarine torpedo boats right off in Long Island sound, and to the fact that the French are very active in this matter. In adding his own opinion as to what the future policy of the navy department should be after inaugurating a submarine service, Engineer Lowe says there should be submarine torpedo boats, submarine gunboats, submarine observation and dispatch boats, submarine counter mines and submarine channel draggers, each kind complete in itself but not combining more than one office. The object I have in mind is to keep the boats down to small dimensions for the sake of handiness and to keep each boat as roomy and as habitable as possible for the sake of the crew.

As a result of the favorable report received by the navy department from the special board appointed to study the Marconi system of wireless telegraphy, Rear Admiral Bradford says that half a dozen vessels will very probably be equipped with the Marconi instruments provided the price is made satisfactory.

"The trouble with Marconi," says the chief of the equipment bureau, "is that he will not sell his instruments outright but wants to dispose of them at a good stiff price and then in addition wants a heavy royalty of so much per annum. His figures are up in the thousands. I have received the report of Rear Admiral Farquhar on the tests made on the New York and Massachusetts, and while I have not read it thoroughly, from all I know of the tests, they were very satisfactory except the feature of interference. Marconi failed to prove that two vessels sending messages to each other could not be interfered with by a third sending out messages. In fact in the tests between the New York and the Massachusetts and the light-house at Navesink Highlands, N. J., whenever two messages were sent out at once neither could be understood, the receiving machines simply making a lot of unintelligible dots and dashes. Marconi has assured me that he has a way of combatting this interference but he has not proved it yet. Even with the interference question unsolved, Marconi's system would still be of considerable value in times of peace for naval movements and for commercial purposes. How valuable the system would be to the navy I am not prepared to say, but Marconi asks too large a price at present for his instruments. It may be that later we can come to some understanding and secure some of his machines."

The Marconi Wireless Telegraph Co. of America, was incorporated in New Jersey a few days ago. The capital stock is $10,000,000, one-half of which is of preferred 8 per cent, cumulative dividend kind. The names of Isaac L. Rice and August Belmont of New York, and C. A. Griscom of the International Navigation Co., Philadelphia, appear among the incorporators.

In its new 6-inch gun the American navy has a weapon which gives better results than the famous Vickers gun of the English service. The fact was developed a day or two ago at the Indian Head proving grounds when the gun was fired for high velocities. The maximum muzzle velocity developed during the day's firing was 2,950 feet per second with the remarkably low chamber pressure of 15½ tons per square inch. During its recent trial at the Indian Head proving grounds the Vickers 6-inch gun developed a maximum velocity of 2,914 feet per second with 17 tons pressure. It is expected that the new gun will develop a muzzle velocity of 3,000 feet per second.

Rear Admiral Hichborn has received from New York some excellent photographs of the Olympia. "The Olympia," said the Admiral, "is the best balanced ship in the navy in power, coal capacity and displacement. During the World's Columbian Exposition the French constructors asked me why the vessel was not more praised by the United States, and why so little is said of her in prints. 'The cruiser,' I answered, 'has her career yet to make. She is going to be Dewey's flagship.' "

CONFIDENT THAT A SHIPPING BILL WILL PASS.

Senator Hanna expresses great confidence regarding the passage of a bill at the session of congress opening next month for the assistance of our merchant marine in the foreign trade. The bill will be in virtually the same form in which it was reported by committees of both houses of the last congress, but Mr. Hanna says he will not introduce it in the senate. The plans are to have it introduced in the senate by Mr. Frye of Maine, the father of shipping legislation, and Mr. Payne of New York will stand sponsor for it in the house of representatives. "It was only through the absence of Mr. Frye last year that my name was connected with the bill," says Mr. Hanna, "but I will, of course, be just as much interested in it as ever."

The new bill will not differ materially from the old one. A sub-committee of the "Committee on Restoration of American Mercantile Marine (representatives of commercial bodies, steamship lines, etc.)" which committee drafted the original bill, has recently held a number of meetings to discuss the bill and the prospects, and it was decided that aside from minor changes in the verbiage designed to make the meaning of certain paragraphs clearer, no changes at all were necessary or desirable. No change whatever has been made in the features of the bill itself and there have been no important additions or omissions.

Cleveland representatives of the leading iron ore interests are still taking all vessels that are offered for next year at $1.25 a ton from the head of Lake Superior, but there is little, if any, Escanaba ore offering now at the dollar rate that was established when the bulk of the vessel capacity was engaged a few weeks ago. The producers of old-range Bessemer ores —leaders as regards prices—have not met as yet, but they will probably take up, during the coming week, the matter of sales for another year. It is quite probable that the base price of these high grade ores for 1900 will be $5.50, as against $2.95 for the present year and $2.75 for 1898. Some Mesabi non-Bessemers have already been sold independent of the action of the high-grade producers at $4.25.

Mr. D. G. Thomson of Montreal, whose death was announced a few days ago, was well known to vessel owners in all parts of the great lakes as manager of the Montreal Transportation Co., a position which he had held for thirty years. He had been engaged in grain transportation on the St. Lawrence for more than forty years.

NAVAL ARCHITECTS—MARINE ENGINEERS.

A MOST SUCCESSFUL MEETING OF THE AMERICAN SOCIETY JUST CLOSED IN NEW YORK—LARGE INCREASE IN MEMBERSHIP—FULL ACCOUNT OF PAPERS AND DISCUSSION.

In point of attendance and interest in the papers presented, as well as the discussion, the seventh annual meeting of the Society of Naval Architects and Marine Engineers, held in New York City on Thursday and Friday, Nov. 16 and 17, easily surpassed any previous gathering of the organization. At no session was the attendance less than one hundred, and at times the assemblage of members and visitors was much nearer the 200 mark. The sessions were held, as usual, at the home of the American Society of Mechanical Engineers, No. 12 West Thirty-first street, which had been courteously placed at the disposal of the society, and in the absence of President C. A. Griscom, Rear Admiral Francis M. Bunce, one of the vice-presidents, presided at all the sessions save the concluding one, during which Mr. W. M. McFarland, formerly one of the engineers of the navy, but now connected with the Westinghouse companies, occupied the chair.

The first business at the opening of the morning session on Thursday, Nov. 16, was consideration of the report of the council, which, at a meeting on the previous afternoon, had instructed that the report of the secretary-treasurer, Mr. Francis T. Bowles, be transmitted with its endorsement as the report of the governing body. The report showed that at the present time the membership of the society aggregates 573, comprising 334 members, 199 associates, 32 juniors, five life members and three life associates. Deaths and resignations occurring during the year were as follows: Deaths—George A. Barnard, Passed Assistant Engineer Frank H. Conant, U. S. N., Jacob C. Cramp, Asst. Naval Constructor R. B. Dashiell, U. S. N., Chief Constructor Alfred A. Dietrich, German Navy, Chief Engineer Robert R. Leitch, U. S. N., Lieut. Commander Sumner C. Paine, U. S. N., W. Louis Sonntag, Jr., Frank Thomson, William H. Webb, and Charles P. Willard. Resignations—Leopold Beck, Charles A. E. King and George B. Whiting, members, and Benjamin H. Cramp and William Swift, associates. A total of thirty-eight members were reported delinquent in dues, the aggregate arrearage being $268. During the year there were sold upwards of 200 copies of various volumes of the transactions of the society and there yet remain on hand about 1,900 copies. The total receipts of the year ending Nov. 15 were $5,614.76, the sum being derived principally from entrance fees, dues and the sale of the publications above mentioned. The balance forwarded from 1898 was $3,641.63 and the expenditures of the year just closed $5,669.64, leaving a balance on hand of $3,586.75. The total resources of the society amount to $13,935.50, which, since there are no liabilities, represents the society's present worth.

LONG LIST OF NEW MEMBERS.

Upon motion there was a unanimous adoption of the recommendation of the council that the following be admitted to membership in the society: Members—Arthur W. Ayer, prof. mechanical engineering, University of Vermont; Thomas W. Bristow, consulting ship builder and marine expert, Cleveland; William F. Carnes, assistant superintending engineer in charge of drawing rooms, Harlan & Hollingsworth Co.; George J. Carter, manager Elswick ship yard, Sir W. G. Armstrong, Whitworth & Co., Ltd.; William G. Coxe, guarantee engineer, Wm. Cramp & Sons Co.; Robert K. Crank, lieutenant U. S. N.; William Hessel Marius de Gelder, Manager L. Smit & Zoon Ship & Engine Building Works, Holland; William E. Elliott, chief engineer Goodrich Transportation Co., Chicago; Eric H. Ewertz, chief constructor Crescent Ship Yard; William Gatewood, draughtsman, Wm. Cramp & Sons Co.; Elias Gunnell, superintendent Chicago Ship Building Co.; H. S. Hodge, president Samuel F. Hodge & Co., Detroit; Carl O. Liljegren, designer Newport News Co.; Luther D. Lovekin, chief draughtsman, engine department, Wm. Cramp & Sons Co.; Alexander J. Maclean, professor naval architecture, Webb's academy; Henry Penton, superintending engineer, Chicago Ship Building Co.; William M. C. Philbrick, draughtsman, navy yard, Portsmouth; Henry S. Ross, captain U. S. N.; John Roberts Sherwood, vice-pres. and general manager, Baltimore Steam Packet Co.; Harry G. Skinner, president Wm. Skinner & Sons' Ship Bldg. & Dry Dock Co.; Francis H. Stillman, proprietor the Watson-Stillman Co.; Gustave R. Tuska, chief engineer Panama railroad and Panama steamship line; Ogle T. Warren, chief draughtsman, Chicago Ship Building Co.; Philip Watts, naval architect and managing director, Elswick ship yard, Sir W. G. Armstrong, Whitworth & Co., Ltd.; Herman Wellenkamp, royal marine shipmaster, Kiel, Germany; Alfred Westmacott, assistant constructor, Elswick ship yard, Sir W. G. Armstrong, Whitworth & Co., Ltd.; Howard Patterson, New York; Robert C. Monteagle; Charles J. F. M. Lilliehook, professor of naval architecture, Royal Technical School, Stockholm; Herbert C. Sadler, assistant professor of naval architecture, University of Glasgow; Charles F. Ward; Carroll S. Smith; Robert Curr, marine surveyor, Cleveland.

Advanced from associate member—Arthur P. Allen, marine engine draughtsman, Newport News Co.; M. S. Chace, assistant inspector of battleships, Newport News; Frederick Pomeroy Palen, draughtsman in charge of engine department, Newport News Co.; William A. Fairburn, chief draughtsman, Bath Iron Works; Daniel C. Nutting, assistant naval constructor, U. S. N.; Gowen Brooks, chief draughtsman, U. S. N., Bath Iron Works; Theodore Lucas, calculating draughtsman, Cramp's ship yard, Philadelphia.

New associate members—Ernest A. Allan, draughtsman, bureau construction and repair, navy department; George E. Barrett, draughtsman, marine department, Newport News Co.; Ralph E. Barry, lieutenant, United States navy, retired; Robert J. Boyd, draughtsman, United States navy, Geo. Lawley & Son, Corp.; Herbert Burton, assistant draughtsman, United States navy, Columbian Iron Works; C. S. Butts, draughtsman, naval station, Port Royal; H. G. Dalton, Pickands, Mather & Co., Cleveland; W. G. DuBose, assistant naval constructor, U. S. N.; J. W. Duntley, president Chicago Pneumatic Tool Co.; Louis Eckert, calculating draughtsman, with Tams & Lemoine; E. F. Eggert, assistant naval constructor, United States navy; A. W. Goodrich, president Goodrich Transportation Co.; William G. Groesbeck, assistant naval constructor, United States navy; Albert R. Jackson, engineer United States light house service; Alexander Kearny, assistant engineer of motive power Penna. R. R. Co.; Otto B. Keller, with Keufell & Esser Co.; Gontran de Faramond de Lafajole, lieutenant French army; George E. Lawrence, ship draughtsman, Wm. Cramp & Sons Co.; William G. Mather, president Cleveland Cliffs Iron Co.; W. W. Meek, draughtsman, United States navy, Newport News Co.; L. T. Myers, vice-president, Wm. R. Trigg Co.; W. C. Nickum, leading draughtsman, hull office Wm. Cramp & Sons Co.; Bernard F. O'Connor, New York; Charles L. Ottley, captain British royal navy; Hubert von Rebeur Paschwitz, captain-lieutenant, Imperial German navy; Joseph W. Powell, assistant naval constructor, United States navy; W. G. Randle, superintendent New York Ship Building Co.; J. R. Raymond, secretary and manager, Standard Automatic Releasing Hook Co.; Ernst F. Rossow, draughtsman, navy yard, Mare Island; Henry H. Schulze, draughtsman, Wm. R. Trigg Co.; H. T. Sloan, engine draughtsman, Penna. R. R. Co.; Godfrey L. Smith, scientific department, Newport News Co.; Edward G. Todt, chief draughtsman, engine department, Chicago Ship Building Co.; G. R. Townsend, draughtsman, engine department, Wm. R. Trigg Co.; B. W. Wells, Jr., lieutenant United States navy; A. B. Wolvin, general manager American Steamship Co., Duluth; W. R. C. Wood, hull draughtsman, navy yard, New York; Allen D. Woods, draughtsman with Tams & Lamoine; William L. Wright, assistant draughtsman, United States navy, Maryland Steel Co.; R. P. Adams, draughtsman, navy yard, Norfolk; Theodorus S. Bailey, draughtsman, United States navy, Crescent Ship Yard; Thomas W. Battin, chief draughtsman, naval work, Newport News Co.; William B. Callison, hull draughtsman, navy yard, New York; W. S. Doran, manager marine department, H. R. Worthington Co., Philadelphia; Isaiah C. Hanscom, draughtsman, navy yard, Portsmouth; Edward McIntyre, superintendent Spedden Ship Building Co.; Lucius M. Michael, draughtsman, United States navy, Harlan & Hollingsworth Co.; Isaac B. Mills, 156 Cypress St., Brookline, Mass.; Harold F. Norton, draughtsman, United States navy, Newport News Co.; J. W. L. Waters, steel hull surveyor; Thomas E. Webb, Jr., hull draughtsman, navy yard, New York; Charles Ackerman; William W. Ackerman; Thomas Dolan; Henry F. Donaldson; John R. Gause; assistant constructor, hull department, Harlan & Hollingsworth Co., Wilmington, Del.; Henry S. Reed, with the Keasbey & Mattison Co.; Frank P. Lewis, master electrician, navy yard, New York; George N. Gardiner; Robert L. Ireland, vice-president, American Ship Building Co., Cleveland; Charles Longstreeth, and Maeston Niles.

Juniors—W. R. Ballard, assistant draughtsman, United States navy, Union Iron Works; W. R. Bean, draughtsman, Newport News Co.; Louis A. Brooks, draughtsman, United States navy, Newport News Co.; L. D. Fisher, draughtsman, Newport News Co.; Walter E. Kimball, assistant draughtsman, United States navy, Fore River Engine Co.; James W. McCormack, draughtsman, navy yard, New York; William S. Newell, assistant in marine engineering, Massachusetts Institute of Technology; E. E. Pierce, draughtsman, Newport News Co.; James J. Salmond, assistant editor, American Machinist; D. Stuart, draughtsman, hull department Delaware River Iron Ship Building Works; Edgar P. Trask, draughtsman, scientific department, Newport News Co.; W. A. White, ship draughtsman, Newport News Co.; Frederick C. Whitehouse, draughtsman, navy yard, New York; Charles Winterburn, draughtsman, navy yard, Portsmouth; Walter S. Leland; Harrison S. Cole; Stephen B. Boyd; Horace E. Stechell, draughtsman, engineering department, Wm. Cramp & Sons Co., Philadelphia.

OFFICERS AND MEMBERS OF THE COUNCIL.

Following the election of the new members there was a unanimous endorsement of the recommendation of the council for the election of the following officers:

President—Clement A. Griscom.

Vice-Presidents—Charles H. Cramp, Philip Hichborn, Chas. H. Loring, George W. Melville, George W. Quintard, Irving M. Scott, Frank L. Fernald, Francis M. Bunce, Wm. T. Sampson, Edwin A. Stevens.

Members and Associate Members of the Council—Wm. F. Durand, Francis T. Bowles, French E. Chadwick, H. Taylor Gause, Nathaniel G. Herreshoff, William H. Jacques, John C. Kafer, Frank B. King, Frank E. Kirby, Jacob W. Miller, Washington L. Capps, Edward Farmer, Lewis Nixon, Harrington Putnam, W. I. Babcock, Horace See, E. Platt Stratton, Stevenson Taylor, George E. Weed, James E. Denton, Walter M. McFarland, Geo. W. Dickie, Cecil H. Peabody.

Executive Committee—Francis T. Bowles, Chairman; H. T. Gause, Harrington Putnam, Lewis Nixon, Edwin A. Stevens, Clement A. Griscom, Ex-officio.

Secretary and Treasurer—Francis T. Bowles, U. S. N., 12 W. 31st st., New York.

On motion of Col. Edwin A. Stevens the society adopted a highly eulogistic minute of the late William H. Webb, which was ordered spread on the records and presented in engrossed form to the family of the deceased. Similar resolutions upon the death of Thomas W. Hyde were

presented by Lewis Nixon, who paid a most handsome tribute to his brother ship builder. As in the former case adoption was by a unanimous vote.

Rear Admiral Bunce made a few remarks expressive of the regret of the members by reason of the inability of President Clement A. Griscom to be present and then the annual address of the absent officer was read. President Griscom's address has been mailed to all members of the society. He refers to the wonderful growth in membership since the society was organized, seven years ago, but notes that the dues are very low, much lower in fact than those of any other similar society, and the council has therefore had under consideration the question of increasing the dues. "Whatever may be the political, moral or constitutional aspects of a policy of expansion," says Mr. Griscom, it is not without advantages to ship builders. The large number of vessels purchased by the government last year for use of the army and navy, together with increasing use of steam vessels in the coasting trade have produced the greatest activity ever seen in our coast ship yards, both on the Atlantic and the Pacific oceans. The orders for large steel steam vessels now taken, for coasting trade especially, exceed largely those of any year in our history." Mr. Griscom makes use of some of the latest statistics regarding ship building on the great lakes, showing twenty-six new vessels valued at $8,000,000, and says, referring to Atlantic coast yards, that at least nine large steamers, recently built, have been added to the coasting or West Indian trade in the past year. "But this has no reference," Mr. Griscom concludes, "to our shipping in the foreign trade. The proportion of our export and import trade carried in American bottoms is still too small to be mentioned, and last year was smaller than ever before. To make this percentage a respectable one would require ten times the number of American ship yards working at full time for a number of years. While we have the materials, the tools and mechanics, the successful building of a modern vessel from a commercial point is in reality a triumph of organization of the multitude of diversified trades which it includes. This stage is yet to be reached and can only be attained by regular systematic production. Production depends upon a market and upon traders who see a profit to be made in ship owning under the laws of the United States."

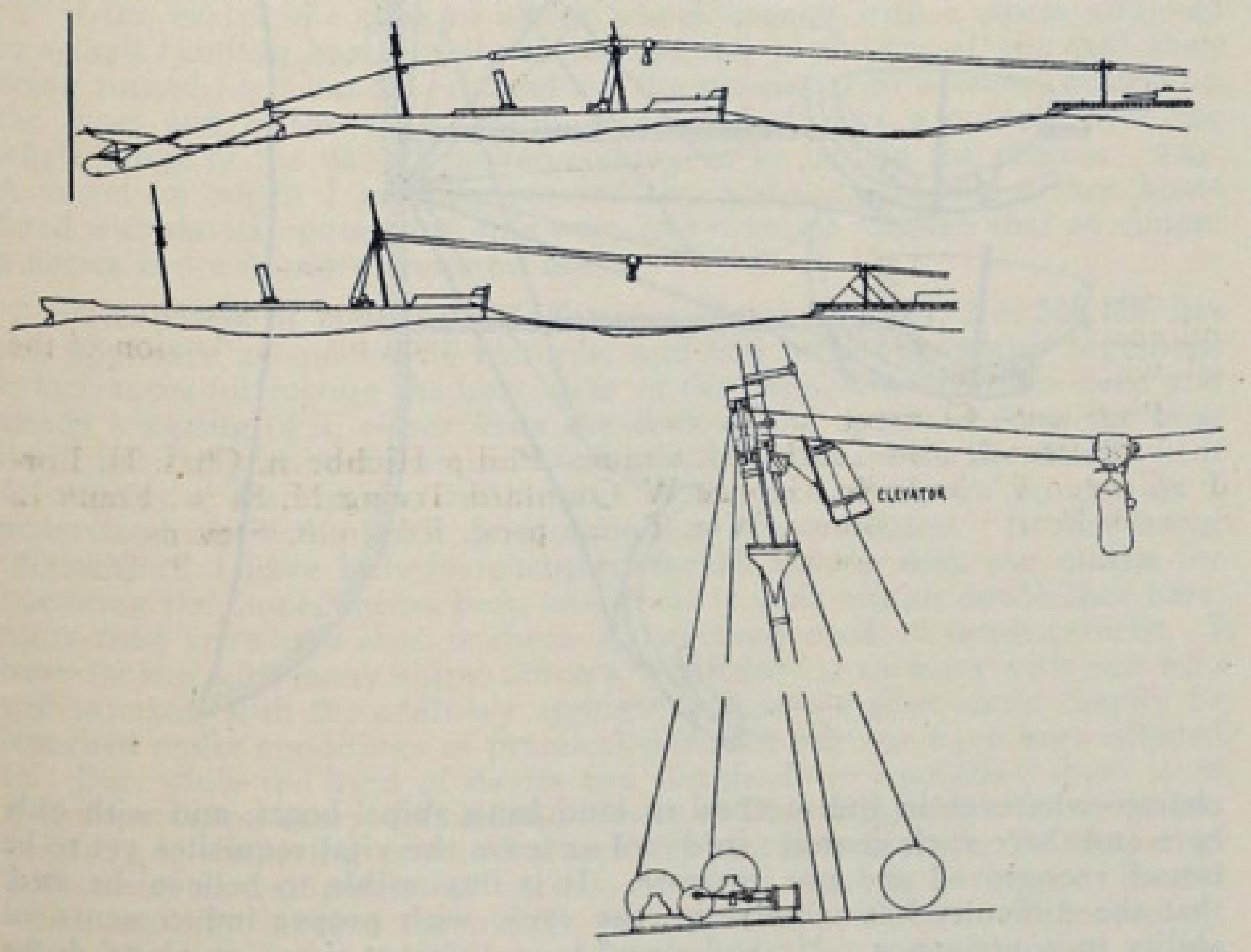
READING OF PAPERS.

LIDGERWOOD DEVICE FOR COALING VESSELS AT SEA—DISCUSSION OF ADMIRAL MELVILLE'S PAPER ON WATER-TUBE BOILERS.

The first paper on the program, "Coaling Vessels at Sea," was read by the author and was supplemented by the display of a very handsome collection of stereopticon views and a working model of considerable size. That no discussion followed the reading of the paper was undoubtedly attributable to the fact that the subject was completely covered in the paper itself.

This paper was mainly valuable on account of the description which it contains of a coaling device with which the navy department is now making experiments on the collier Marcellus. The author, Mr. Spencer Miller, is with the Lidgerwood Manufacturing Co. He refers at considerable length to previous attempts to perfect a device for coaling vessels at sea and to the disadvantages encountered on this score by our vessels during the late Spanish war.

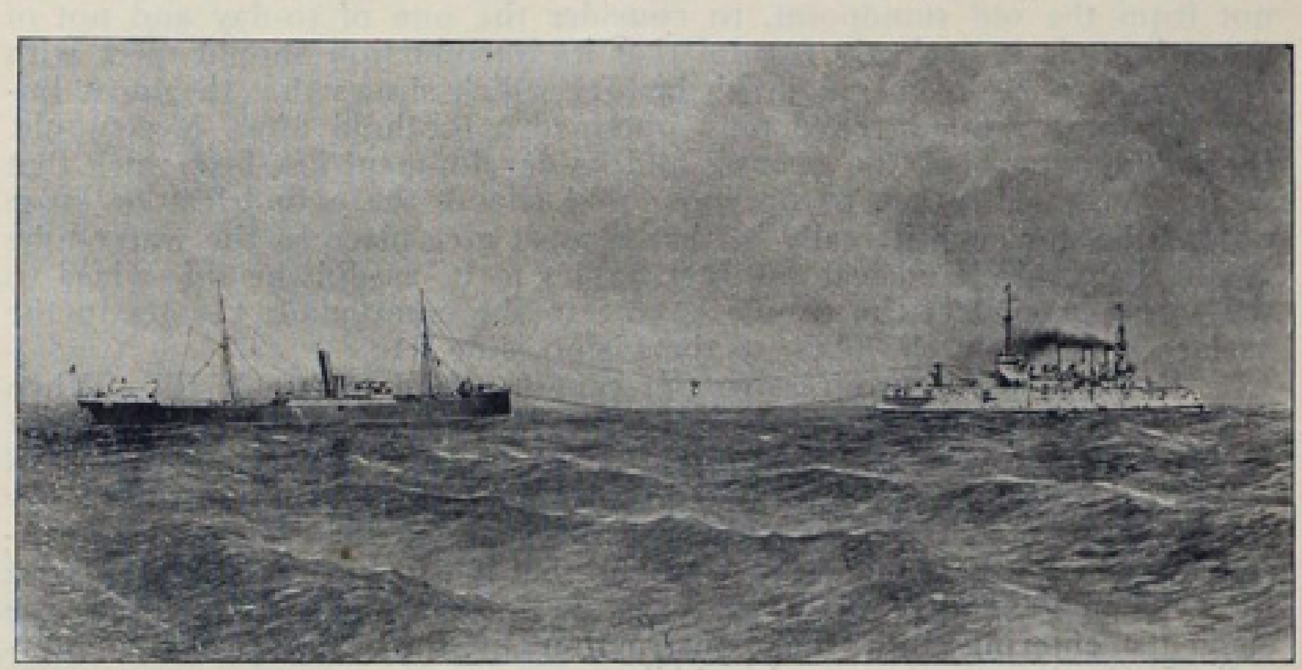
"Becoming interested in this question in 1893," says Mr. Miller, "I proposed at that time, to stretch an elevated cable from the stern of the warship to the bow of the collier in tow, one to be securely fastened to the warship and the other end wound around the compensating engine, similar to the steam towing machines. The load running on this cable was to be conveyed over by an endless rope. It was expected that the compensating engine would keep an equal strain on this elevated line irrespective of the pitch of the vessels so connected. In March, 1898, Lieut. J. J. Woodward, naval constructor, located at Newport News, Va., invited plans and prices on a device containing much the same general ideas. A few weeks later a plan was sent to Mr. Woodward, and he in turn transmitted it, with favorable recommendations, through the chief



constructor, to the secretary of the navy. It was not, however, until August of the same year that any understanding was had with the navy department whereby the work of construction could be begun. The plan, considerably modified, was submitted to a board of naval officers, consisting of Rear-Admiral Ramsey, Thomas Williamson, and Z. L. Tanner, and they considered the device 'feasible in moderate weather.' Thereupon the department contracted with the Lidgerwood Manufacturing Co. of New York City, to have the apparatus installed on board the collier Marcellus. So much time was lost in negotiations, however, that before the work of construction was begun the war came to an end. On Oct. 15, 1898, the author performed an experiment in New York harbor with a tug, towing a sloop, using a quarter-sized model. Shear poles were mounted on the tug, and blocks on the mast of the sloop, the distance between points of support being 100 feet. An endless rope was employed, being used in accordance with the plan shown herewith. A movable sheave in the bight of the cable aft the mast was held taut by a line connecting it with a sea anchor or towing cone dragged in the sea behind the sloop. By this plan it will be observed that the tug towed the sea anchor as well as the sloop, the latter merely supporting the rope as it passed over. A carriage gripped to the upper part and provided with wheels to roll on the lower part served to carry the bags of coal over from sloop to tug. As the experiment was performed in a storm no photographs were taken. The storm was so severe that the sloop shipped water over the bow, and both boats rolled and pitched very badly. In spite of this, however, the bags of coal were conveyed across the space as though the sea was smooth, the sea anchor serving to perfectly act as a compensator, maintaining a constant tension on the endless conveying cable. If such a plan were adopted, the sea anchor would have to be selected in accordance with the speed of towing; the greater the speed the smaller the cone required.

DESCRIPTION OF THE MILLER CONVEYER ON THE U. S. S. MARCELLUS.

"It is proposed, with this device, for the warship to take the collier in tow, or the collier to tow the warship, leaving the distance between ships about 300 feet; this method of securing boats at sea is recognized as being safe. The warship to receive the coal will erect a pair of shear poles on its deck, which, secured by guys, will support a sheave wheel and a chute to receive the load. The collier is provided with a specially contrived en-



gine located aft the foremast, having two winding drums. A steel cable, ¾-inch diameter, leads from one drum to the top of the foremast, over a sheave, thence to the sheave on the warship, back to another sheave on the top of the foremast, thence to the other drum. This engine gives a reciprocating motion to the conveying rope, paying out one part under tension; a carriage secured to one of the parts passes to and from the warship, its load clearing the water intervening.

"A carriage of special form is provided with wheels which roll on the lower part to the conveying cable, and grip slightly but sufficiently the upper part of the cable. This carriage will carry bags of coal 700 to 1,000 pounds. The load is held by a hook pivoted at the bottom of the carriage, which hook is held by a latch. When the carriage comes in contact with the rubber buffer on the sheave block at the warship, this latch is pressed in, thereby releasing the hook and its load. Should the carriage strike heavily at either terminus the upper part of the cable will slip through the grip and no damage will be done. As soon as the bags are dropped, the direction of the rope is reversed, and the carriage returned to the collier. During the transit of the load an elevator car descends to the deck, bags of coal placed thereon, suspended from a bale, and elevated again to the stops on the guides, so that when the carriage has returned to the collier, the pointed hook finds its way under the bale or hanger supporting the coal bags. The instant the load is hooked on, the direction of the ropes is again reversed, the carriage takes its load from the elevator and transfers it across the intervening space to the warship, and drops it again into the chute.

"The engine for operating the conveyer is of peculiar construction. It runs practically all the time in one direction, its speed being varied by the use of the throttle. The drum near the foremast is provided with friction mechanism so that it is capable of giving to the rope a tension anywhere from 1,000 to 4,000 pounds. This drum is operated by a lever. The other drum is of special form, employing two dry metallic surfaces in contact. This drum is adjusted so that it will slip under any strain exceeding, say, 3,000 pounds. It may be adjusted while the operation is going on, the tension being increased if the load sags too much, and diminished if the deflection is unnecessarily small. The forward drum will be referred to hereafter as the 4,000-pound drum, and the other as the 3,000-pound drum. When the engine is running, the tendency of both drums is to draw both parts in, one to the extent of 4,000 pounds and the other 3,000 pounds. The effect, therefore, is for the 4,000-pound drum to prevail and overhaul the 3,000-pound resistance, and it is this resistance that sustains the load in its transit between the two boats. Through the co-operation of the two drums the conveying distance between the two boats is compensated for and a practically uniform tension sustained during the transit of the load. If the points of support on the two ships approach each other (during the transit of the load) the effect will be that the drum pulling 4,000 pounds will take up the slack so produced, and the 3,000-pound drum will temporarily cease slipping, or at least the slip will be reduced. If, now, the boats pull apart, the 3,000-pound drum will simply slip the

faster. All that is necessary, therefore, in the operation of this machine is to see to it that the speed of transit is in excess of double the speed at which the two boats come together.

"After the load is dumped at the warship the operator of the engine releases the friction lever on the 4,000-pound drum, thus reducing the tension on the lower part to some point considerably below 3,000 pounds, whereupon the 3,000-pound drum acts to haul in rope, and thus returns the carriage to the collier. The speed of conveying is about 1,000 per minute, consequently the load will be taken from the collier and deposited in the warship in about twenty seconds. Attention is called to the fact that the total tension on these two parts of rope will never exceed, say, 8,000 pounds; furthermore, should the ships pull away from each other and the tow-line part, the only effect will be to unwind the rope from one of the drums, its end falling into the water, whereupon the other drum will wind in the other end of the rope and recover the carriage attached thereto. The drum used for operating the conveyer also serves to wind up and store the cable when the collier is not coaling at sea."

DISCUSSION OF ADMIRAL MELVILLE'S PAPER.

In the absence of Rear Admiral George W. Melville his paper on "Causes for the Adoption of Water Tube Boilers in the United States Navy" was read by W. M. McFarland, formerly one of the loyal supporters of the engineer-in-chief, while connected with the bureau of steam engineering, but now with the Westinghouse companies. Rear Admiral Melville's paper will be found in full elsewhere in this issue. The discussion was opened by Mr. Horace See, who said:

"The paper is one that should not be allowed to pass without something more than general comment. The past ten years have been marked by a development that has given us not only superior material and better facilities, but has also made possible results heretofore unobtainable, so that we are called upon to view the water tube boiler from the new and not from the old standpoint, to consider the one of to-day and not of yesterday. It is perfectly natural that its introduction should meet with opposition to be in keeping with history which shows that the most important improvements have only obtained a foothold after a struggle. Its introduction needs no excuses and its development has been such that we can very safely say to our good old friend, the cylindrical or large water tube, for such it really is, that it must give place to the water tube as did the semi-cylindrical and rectangular to it; as did the side-wheel to the screw propeller; the simple engine to the compound; the jet to the surface condenser; the plain to the piston slide, etc.

"Engineering is progressive. It cannot afford to stand still. When it does we must expect decay. It does not follow from this that we must accept every novelty presented, but must, however, take advantage of every real improvement or be content to remain in the same old rut. My acquaintance with the water tube boiler makes me believe that the principle on which it is founded is sound and that it will bear comparison with the type in general favor. This opinion is based on the fact that the elements entering into the construction of the cylindrical, or internally-fired, large water tube boiler, are more numerous and more dangerous than those entering into its construction; also more difficult, as well as more expensive, to look after and keep in repair. The tube exists in this boiler as well as in the other, subjected to the same causes that produce decay and injury. We have in addition the furnace liable to collapse, the combustion chamber subject to eating away and leaking at all joints, and the immense shell subject to injury at the joints from the unequal expansion and contraction of the thick plates. The tube being the only part considered dangerous in the water tube, I think we may pass this objection if solid-drawn steel tubes, now possible, of proper thickness are used. These tubes, however, must be arranged to perform their duty not only in regard to economy but also as to life and safety. If, however, they are not submerged or so formed or arranged as to prevent the water from coming in close contact with all parts subjected to the hot gases, they will suffer more rapid deterioration or become loosened at the ends. The bulging of the drums of the water tube boilers of the Nashville must not be charged to this type of boiler, as the same thing has happened to all types where the gases have been allowed to come in contact with the metal where steam and not water is against its other side. The change of shape of the drums no doubt may also have had something to do with the leaky tubes.

"I believe that a boiler built with straight, submerged tubes, and no part of the steam space exposed to the direct contact of the gases, possesses greater advantages than those enumerated in the paper, whilst the disadvantages are less, and consequently there is no reason why the following is not a correct assumption: First, that the tubes of the water tube boiler will stand the work if solid-drawn and of proper thickness. Second, that the boiler without stays and numerous narrow water spaces difficult of access, and large cylinders liable to collapse, must certainly call for less skill to manage than one with them. Third, that the simple machine must require less skill to manage than the complex. Fourth, that small, simple units with accessibility are not a disadvantage whilst large ones without it should be placed in this class; no one today takes exception to the increased number of units in the steam engine; why should we in the boiler if smaller and safer parts are obtained. Fifth, that steam can be generated only from water, so that the surface below the water level should only be counted for this purpose, and if this is done when the comparison is made with the cylindrical, I believe the heating surface of the one type will be found as effective as that of the other. Sixth, that it is an open question whether the small reserve of water is a disadvantage where high pressures are carried, as the shorter time required to empty and fill, as well as to obtain steam, should be considered in this connection. Seventh, if we take into account the number of plates, rivets, tubes, the different kinds of stays, crown bars and bolts that enter into the construction of a cylindrical boiler, we will undoubtedly find fewer parts in a water tube boiler generating the same amount of steam. Eighth, that the water tube boiler should not be found difficult of access except in case of failure of a tube and then, with the small body of water carried, their plugging or replacement can be quickly done. Ninth, that although we have more tubes, the joints or parts liable to leakage will be less than in the case of the cylindrical. Tenth, that the high pressure of steam carried is a preventative against priming.

"The foregoing advantages are based on the boiler being of good design with straight, submerged, solid-drawn, steel tubes and with drums made throughout of wrought steel. In such a boiler we will have characteristics that will rank higher than those in our good, old friend, the cylindrical or Scotch, and that will make it capable of employment in vessels of all classes."

Mr. George W. Dickie, manager of the Union Iron Works, San Francisco, endorsed the declaration in favor of straight tubes. He pointed out that the difficulty of replacing bent tubes was serious. But while the subject was unquestionably one of the greatest importance in ship development, Mr. Dickie did not think that the water tube boiler had yet reached the stage where it was to entirely displace the cylindrical.

Naval Constructor J. J. Woodward, who is stationed at the Newport News ship yard, pointed out that the introduction of the water tube boiler involved questions of space and weight in ship construction, and that even the matter of stability might be embraced by reason of the fact that when the tanks are filled a large weight is added to the bottom of the vessel. Summarizing he said that the water supply for the boilers, when large plants are carried is a matter of importance to the naval architect.

Mr. John Platt of Thorpe, Platt & Co., of New York, took a position similar to that of Mr. Dickie in the declaration that the water tube boiler which fills all requirements has not yet been devised. Practically, all the water tube boilers in the British navy, he said, had given trouble.

Mr. F. L. DuBosque favored water tube boilers for ferry boats. He stated that his company had found it impracticable to use cylindrical boilers when the ferry boats run 75 per cent of the time and remain in the slip 25 per cent of the time. Water tube boilers had been in use in some of the ferry boats in the harbor during the past three years and the theory outlined had been carried out nicely. Moreover, actual experience had proven that the use of boilers of this type enabled a saving of from 15 to 18 per cent in fuel in the service of his company.

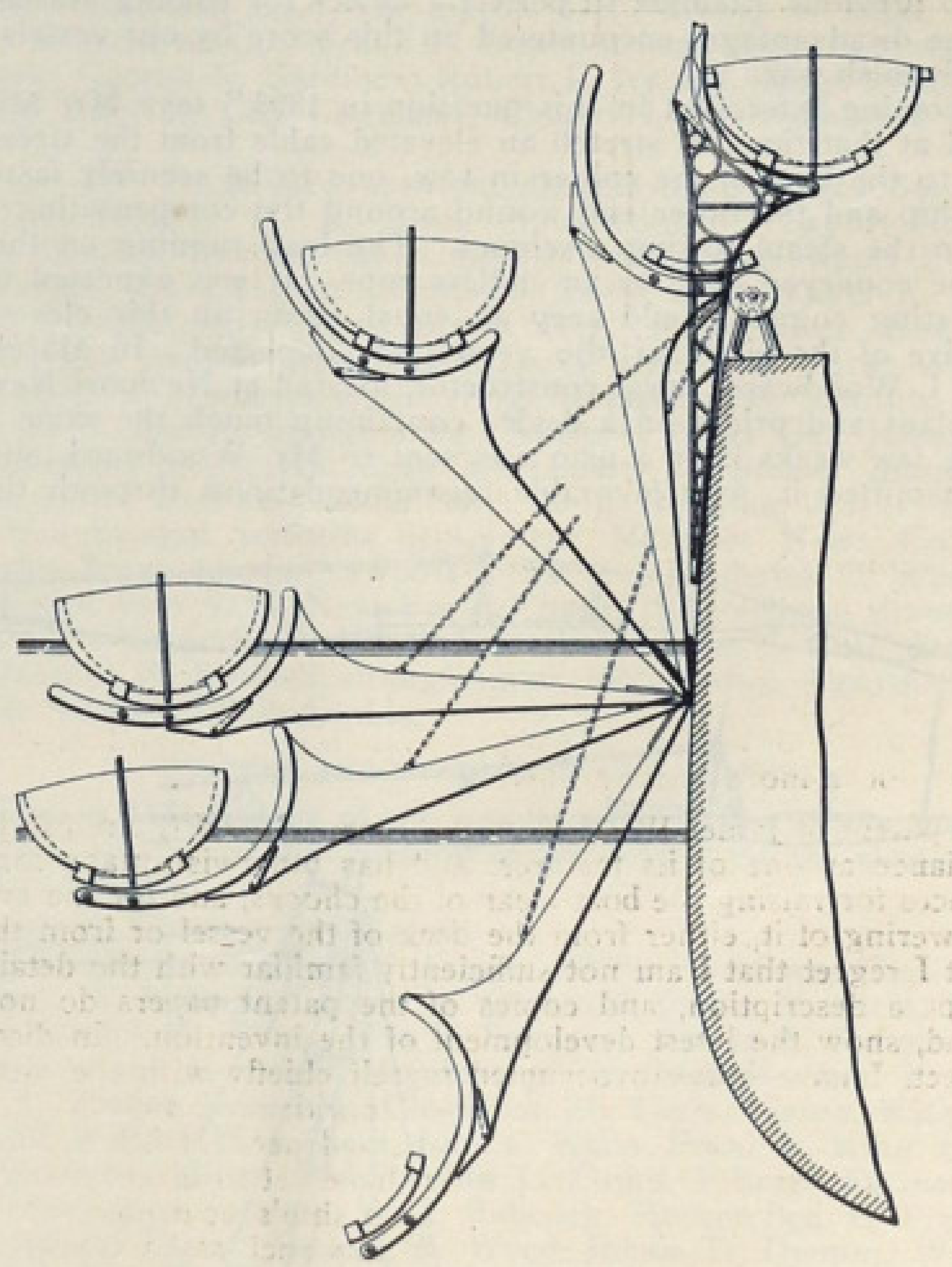
Mr. W. D. Forbes spoke of the lack of provision for cleaning water tube boilers as exemplified by the experiences of the men who had in charge the making of repairs on the boilers on the United States vessels engaged in the Spanish-American war, and Mr. McFarland closed the discussion with a few brief remarks.

LIFE SAVING APPLIANCES.

SUGGESTIONS AS TO DEVICES FOR LAUNCHING SHIPS' BOATS—AN INTERESTING PAPER ON A VERY IMPORTANT SUBJECT.

Mr. John Hyslop, official measurer of the New York Yacht Club, and who was on board the steamer Mohegan when she was lost on the Manacles about a year ago, was present in person and read his paper "Suggestions as to Improved Appliances For Launching Ships' Boats." It was illustrated with a working model.

Mr. Hyslop directed attention first to the fact that the vast development of ocean travel in the past half century and the increased water traffic of every kind has been unattended, excepting in rare instances, with any

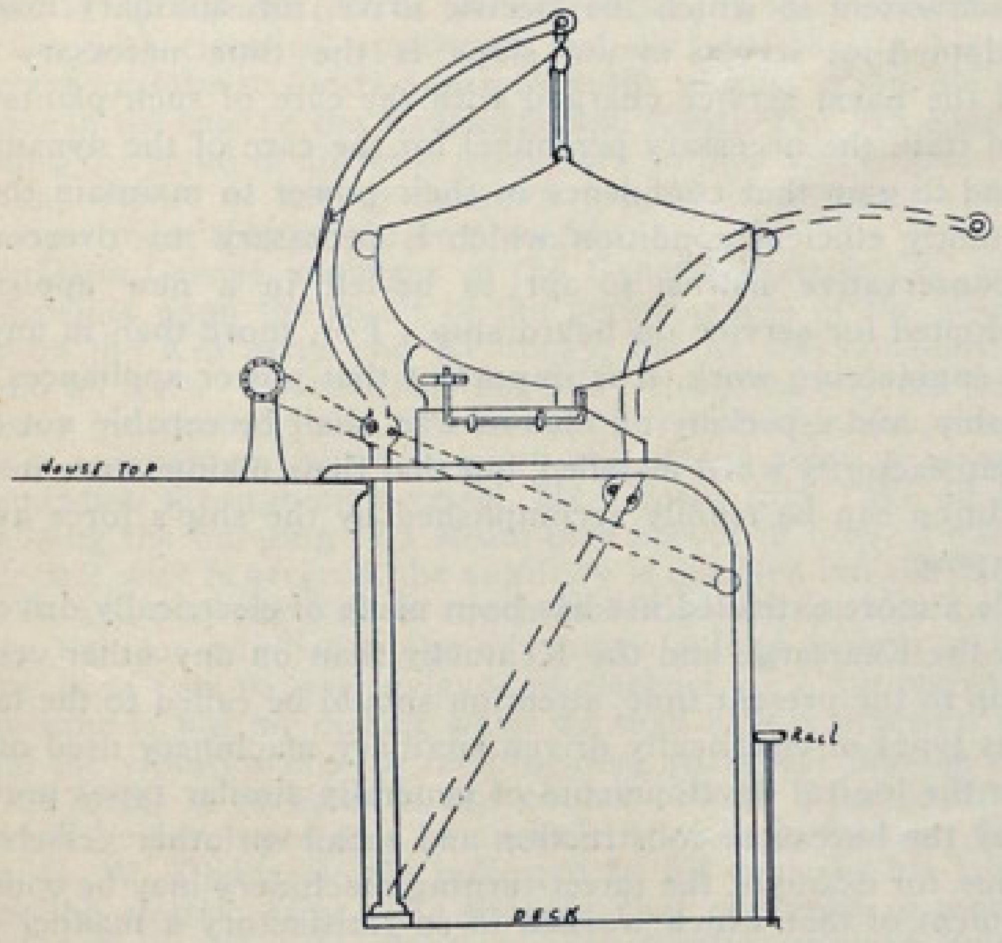


change whatever in the method of launching ships' boats, and with only here and there such changes in detail as leave the vital requisites yet to be found, recognized and put into use. It is impossible to believe, he said, that the difficulty lies wholly in the lack, with proper inducements, of ability in contrivance. He had stood four different times on ships' decks when it has been necessary to launch boats to save life, and on none of them was this quickly and effectively carried out.

In the search for new forms of davits it is questionable if the same identical form will be found equally applicable in all cases; and even if the same form is found to be generally applicable, some modification of detail

will be necessary. To his mind the principle of the Mallory davit, patented in 1871 and 1873, has much to recommend it; it is simple and vastly superior to the common form. It is inexpensive, not bulky, has no need of guys. The boat, though kept inboard, is always outside the davits, and gravity alone will carry the boat outward, ready for lowering, when the ship is on an even keel or only moderately listed, and when more extremely listed any force used to overcome this is more easily and much more effectively applied. Any reference to the class of davits which fall outward from the sides of a vessel would be very incomplete which should omit to notice the ingenious and well-worked-out device of Sir Bradford Leslie of Falmouth, England. Sir Bradford is a retired engineer of much experience in the East Indies. His life was placed in jeopardy by shipwreck some years ago, and he has shown that he possesses the requisite technical skill to deal with the detail of his invention in a very thorough manner. For acquaintance with it reference may be made to the United States patent, May 4, 1897, number 582,069, from which the accompanying sketch is reproduced. The chief novelties of this method are that there are no boat falls, no lowering or hoisting tackles attached to the boats—these are supported from below on cradles situated on the heads of the davits. The davits themselves are lowered vertically in slides down the outside of the ship through a space of a few feet; having passed downward through this space, the heads of both davits, with the boats resting upon them, fall evenly outward and downward, until the boat is deposited on the water at an oar's length or more away from the ship, the davits being allowed to sink a sufficient distance free of the boat. The lowering apparatus consists of a wire rope wound round a drum on the ship's deck, and fitted with a suitable brake. A full description of this contrivance would occupy more time and space than is available. In regard to the invention, it will be conceded that it possesses great originality and thoroughness—that it attains to many desirable ends. If it is thought to be too elaborate or too costly to meet with practical acceptance, it will still be deemed a sufficient reason for a reference to it in this paper that its methods are novel and calculated to afford a variety of useful suggestion.

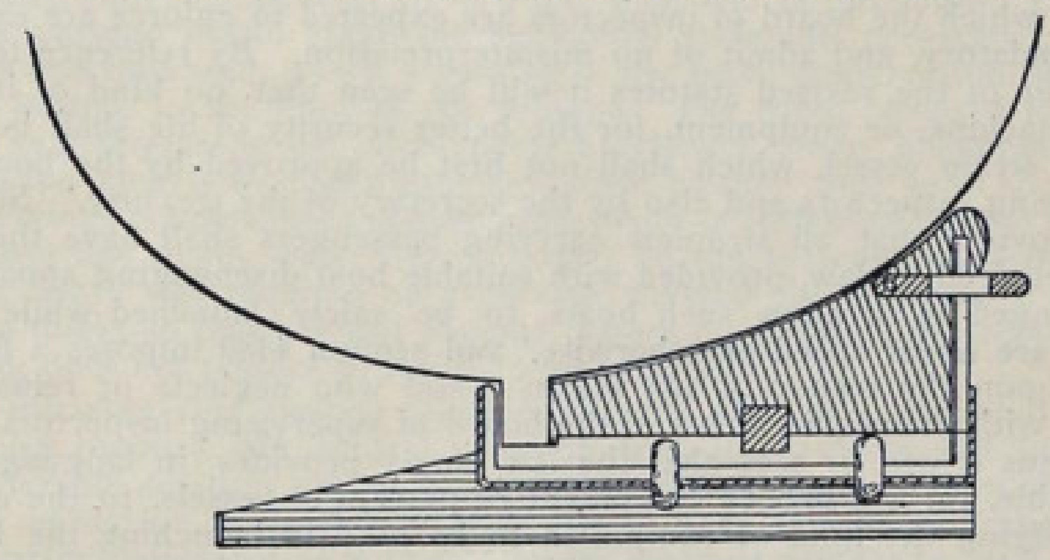
"It appears doubtful," Mr. Hyslop continued, "if any simple and reliable means can be devised for getting boats ready to lower where the davits have to be rotated, and where the boats have to be moved from a position inside the davits to one outside of them, and this operation, so easy when the deck is level and still, becomes one of extreme difficulty when the vessel is rolling, or when she is inclined; ordinarily the work involves time and effort which ought to be eliminated. The use of a cog-



wheel secured to the vertical part of the davit, say immediately over the rail of the vessel, the cogs of which wheel engage with a worm attached to a shaft running horizontally across the rail of the vessel, the said shaft being turned by a handle situated on the periphery of a wheel placed on the inner end of the shaft, seems calculated to give a control over the whole range of the davit's movement not to be had in the ordinary way. A vessel on which I recently crossed the Atlantic had two of her boats fitted with davits operated in this way, and it seems strange that so simple a device is not in more common use.

"The patent of James W. McKinnon, March 16, 1897, No. 579,119, has this appliance as one of its features, and has otherwise many ingenious contrivances for raising the boat clear of the chocks, and for the even and steady lowering of it, either from the deck of the vessel or from the boat itself; but I regret that I am not sufficiently familiar with the details of it to attempt a description, and copies of the patent papers do not, as I understand, show the latest development of the invention. In discussing this subject, I have hitherto occupied myself chiefly with the means for operating the davits themselves, and there is with me no doubt that here, more than anywhere else, is there a confessed need of improvement. I have spoken with many ships' officers, but have yet to meet with one who will say that, with the ordinary appliances, a ship's boat could readily be launched under conditions of practical difficulty such as have been alluded to. But, while the kind of davits and the mode of operating them is of first importance, every detail and process of launching ships' boats is important and deserving of more attention than it appears to be receiving. Differences in equipment of vessels, often in regard to simple details which scarcely involve the matter of expense, and which do materially affect efficiency in working, suggest as explanation either a want of interest or a need of information, or even, more probably, the need of an institution or of a body of men who, duly qualified, could more than any individual be confidently relied upon to acquaint themselves with these somewhat technical matters, to digest the information received, and to make such statements or recommendations as should appear to be called for in the interests of humanity. With a large measure of authority would come, from such a body, a pronouncement in regard to any davit device observed; also in relation to the respective merits of iron and wooden boats; to the advantages of cork fenders carried in the form of bolsters around a boat and below the gunwale. Chocks and releasing tackle would receive attention, gripes and davit guys would also be commented on, and probably for the guys, if these must continue to be used at all, tackles instead of lanyards would be recommended.

"The differing situation of boats about vessels' decks is deserving of consideration,—some on chocks near to the deck level and needing to be hoisted several feet to pass over a rail; some kept at rail height and too high for passengers to get into them; some overhead and inaccessible until lowered outside the rail; and some, like the boats of the Kaiser Wilhelm der Grosse, placed upon, and close to, the upper deck, having no rail either inside or outside of them, themselves constituting a bulwark, and ready to be launched with all the facility attainable where the ordinary davit is in use. Where the simplification of every process means so much, attention may here be called to the double use of the cork bolster put round the life-boats of the vessel mentioned; this is not only a protection to the boat in case of collision with the vessel or otherwise, but it affords an admirable means for securing, and for instantly detaching, the canvas cover, which ordinarily is fastened over the boat when it is upon the deck. This cover extends over the sides and down beyond the bolster, and has a loose lacing of small rope rove through grommets upon the edges, a line passing through the lacing along each side the boat is tightened up and the ends toggled together at stem and stern, the effect being to gather the edges of the cover inward under the bolster, and to secure it, and again to instantly release and free it, when this is desired, by slipping the toggle. The cover in this way is removed intact in very much less time than it could be cut adrift by a sharp knife. Of the various means in use of throwing down the chocks on which the boat rests, or at least of removing the outer ones so that it can be launched, those on the Kaiser Wilhelm



der Grosse seem adequate and nothing could be more simple. Any pressure from wind or from a sea shipped would be from the weather side, and would bear inward. On the inner side the boat is supported by the two chocks in the customary manner, and is held in firm contact with it by the gripes. It is held from moving outward by an iron rod, carried from inboard outward and horizontally through eye bolts on the face of the lower part—the stationary part—of the chock; this rod is turned up at a right angle, for a few inches at the outer end, in such a way as when operated from the deck at the inner end, where a lever handle is situated, the outer end is turned up outside the keel and the boat's movement is prevented.

"The matter of releasing gear is too important to wholly omit mention of in a consideration of this subject; there can, I think, be little doubt that in rough water, with ship and boat in active movement, the handling of boat falls and hooks is attended with both difficulty and danger, even in daylight—it is of course even worse in darkness—whether this be done for the purpose of letting go or of hooking on. It is important that the two ends of the boat be lowered evenly, and that the falls be so rove through the blocks that if one end be let go, the other, either by getting foul or being held onto, may not prevent both ends of the boat descending to the water and becoming water-borne. There are many devices for detaching the lower hooks, not all, perhaps, equally free from the risk of fouling, or sure of smooth and reliable working. It might be invidious to select one for preference, unless indeed from a more intimate acquaintance with the history of its working than I can claim; the United States government and many merchant vessels have, however, I understand, made considerable use of one of these which appears to me to be a good contrivance, and is well deserving of attention. I will only say, in conclusion, that whatever appliances are used should be kept in good working order. If wooden boats are used these should not be dried out and leaky, so that they cannot be kept afloat, as has too frequently happened; boat falls should be of good pliable rope that will run easily and freely through the blocks, without choking and without kinking; and for the rest, if the present means for launching boats in times of difficulty and disaster are not improved upon, and if it should ever again be my misfortune to have a ship go down under me, I hope the temperature and distance may admit of my swimming ashore, as otherwise I would rather put my trust in a spar, hatch, or plank, or in anything that might float than in the likelihood of getting boats properly afloat in any short period of time. I trust that I may here be permitted to suggest that the appointment of committee from the members of this association to thoroughly investigate and consider this subject would give promise of results, such as would be eminently beneficient, worthy of the effort made, and of the society, and not so well attainable by any other means in sight."

DISCUSSION OF MR. HYSLOP'S PAPER.

Discussion of Mr. Hyslop's paper was opened by Capt. W. G. Randle, late commander of the American liner St. Paul, who advocated the adoption of double-ended boats, which could be launched on either side of a ship. He was followed by Mr. Hyslop who made a few remarks supplementary to those contained in his paper. Mr. Hyslop called attention, first of all, to the danger from icebergs and derelicts, and stated that all the precautions possible could not prevent ocean disasters, which were not confined to any one line. He urged that a committe of the associa-

tion be appointed to take some steps toward securing the adoption of better appliances. On motion of Naval Constructor Capps the whole question was referred to the executive committee.

Mr. E. Platt Stratton talked of the importance of appliances for releasing the boats when they strike the water. Skill was needed, he declared, for if the controlling force be not present the boat will be dashed against the side of the vessel. The best disengaging apparatus is that which disengages at both ends simultaneously, but all appliances are useless unless the boat be properly handled after launching. For this reason he believed that skilled surfmen were badly needed on ocean liners.

SEVERE CRITICISM OF THE STEAMBOAT INSPECTION SERVICE.

James R. Raymond of New York, submitted to the society a severe criticism of the steamboat inspection service, along the line of Mr. Hyslop's paper.

"I am of the opinion," said Mr. Raymond, "that the authorities having these matters in charge, and who by law must take the initiative, will be influenced by an expression of opinion of this society, and may be induced to pay such regard to the subject that inventive genius will be stimulated in this direction, and beneficial results follow therefrom. The matter of life saving appliances, and all equipments of passenger steamers named by law, and under the immediate direction of the United States board of supervising inspectors of steam vessels. By law they are made the judges of the best devices and appliances, which after being approved by them and receiving the endorsement of the secretary of the treasury, become compulsory for adoption and use on the part of steam vessel owners. The board of supervising inspectors as created is supposed to be composed of men selected for their fitnes for the duties they are expected to perform. While their decisions by law require the approval of the secretary of the treasury to make them legal, the board is entirely independent of the secretary in their rulings. The United States revised statutes, relative to steam vessels, which the board of inspectors are expected to enforce are explicit and mandatory, and admit of no misinterpretation. By reference to section 4491 of the revised statutes it will be seen that 'no kind of instrument, machine, or equipment, for the better security of life shall be used on any steam vessel, which shall not first be approved by the board of supervising inspectors and also by the secretary of the treasury.' Section 4488 provides that 'all steamers carrying passengers shall have the lifeboats required by law, provided with suitable boat disengaging apparatus, so arranged as to allow such boats to be safely launched while such vessels are under speed or otherwise,' and section 4489 imposes a fine of $1,000 upon the owner of any steam vessel who neglects or refuses to comply with the requirements of the board of supervising inspectors.

"Thus it will be seen that the law amply provides, in language unmistakable, for the proper equipment of passenger vessels, to the extent of specifying the kind of equipment to be used in launching the boats, and imposes a fine for non-compliance with the requirements specified. It is evident that at the time statute 4488 was enacted, Feb. 28, 1871, it was the intention of the framers of the law to insist upon the use of what appeared, and what was at that time the most reliable apparatus extant, namely, one that was operated by a lever, detaching both ends of the boat from the lower blocks at the same time, and which is described and embodied in the statutes in the following language: 'Shall have the lifeboats required by law provided with suitable boat disengaging apparatus, so arranged as to allow such boats to be safely launched while such vessels are under speed or otherwise, and so as to allow such disengaging apparatus to be operated by one person, disengaging both ends of the boat simultaneously from the tackles by which it may be lowered to the water.'

"The law entrusts this board with the selection and enforcement of such measures as will best secure the safety of persons traveling by water, and it also, in terms positive, instructs how it shall be done. The board of supervising inspectors should, therefore, be eager to determine the best appliances for the purpose and enforce their use without fear or favor. But it is plain to anyone familiar with the proceedings of the board relative to detaching apparatus, that they have aimed to do as little as possible and have shown no disposition whatever to comply with the law, and in so doing, inferentially at least, serve the pecuniary interests of the steam vessel owners rather than those whose lives depend upon the selection of the best means extant for the preservation of human life on shipboard. In substantiation of this it is only necessary to consider the number of passenger steamers provided with no detaching apparatus whatever, other than the antiquated hook and ring, which cannot be considered to be a detaching apparatus in compliance with the specific requirements of the law; and to consider the further fact that some detaching devices which the board, according to the record of their proceedings, have condemned as death traps and whose only recommendation is their cheapness, are allowed to remain in use, to have their defects discovered only in time of disaster.

"The supervising inspector-general has asked that the statutes be amended so that the board might be enabled to select a proper device, claiming as a reason, that according to the wording of the statutes they are prevented from giving their approval of any device other than the one mentioned therein, namely, the one operated by one person, disengaging both ends of the boat simultaneously, etc., etc. Had he the welfare of the public at heart, would he, or the board of inspectors under him, find anything in the language of the statutes that would forbid the selection of any good device, the universal use of which would familiarize all sailors with its operation? Would not the enforced use of a good device, so selected, prevent the terrible blunders and loss of life now so often occurring in emergencies, because of the use of a multiplicity of defective devices? In reviewing the present situation the conclusion appears obvious, and in respect to it I agree with the opinion expressed in Mr. Hyslop's paper, that a thorough examination by a competent body of men, not merely into such matters as I have alluded to, but into the whole subject of launching ships' boats, is a great need of the present time. Such examination earnestly conducted, and the results arrived at impartially expressed, could scarcely fail to receive attention and to stir up a movement towards a much needed improvement."

ELECTRIC PLANTS—COMPLICATIONS IN SHIPS.

TWO PAPERS THAT ARE SOMEWHAT RELATED TO EACH OTHER—MR. DICKIE SUGGESTS A RADICAL PLAN OF OVERCOMING COMPLICATION OF MACHINERY.

Following the discussion regarding appliances for launching life boats, the paper on "Electric Plants of the Battleships Kearsarge and Kentucky," was read by the author.

This paper, presented by Naval Constructor J. J. Woodward, who has for some time past represented the government in the Newport News ship yard, is a very valuable contribution to the proceedings, as the battleships Kearsarge and Kentucky, just completed at Newport News, are the first vessels of the United States navy on which the use of electricity as a motive power for the ships' auxiliary machinery has been adopted to the practical exclusion of steam. It is quite clear from this paper that there is no misunderstanding as to where the construction bureau, under Rear Admiral Hichborn, stands in the matter of electric drive for auxiliaries.

"But even in the case of these vessels," says Constructor Woodward, "a distinction has to be made between the auxiliary machinery for the general service of the vessel, such as deck winches, boat cranes, ship's ventilating fans, ammunition hoists, and turret-turning machinery, all of which are operated by electric motors, and the auxiliary machinery connected with the main propelling engines, such as air, feed and circulating pumps, forced-draft blowers, ash hoists, etc., which on these ships are still driven by small steam engines. Further exceptions to the complete use of electricity for the ship's auxiliary machinery are the windlass and steering engines, which are also driven by steam. The electric plants of the Kearsarge and the Kentucky can, therefore, only be regarded as an intermediate step between the complete steam drive for auxiliary machinery, so largely used in the past, and the practically complete electric drive for all auxiliary machinery of every kind whatsoever, whose adoption appears to be a possibility of the near future. Indeed the most serious present limitation to the extent to which the electric drive for auxiliary machinery may be adopted for service in war ships is the time necessary for the officers of the naval service charged with the care of such plants to organize and train the necessary personnel for the care of the dynamos and motors, and to gain that confidence in their power to maintain the plant in a constantly efficient condition which is necessary to overcome the sense of conservative distrust so apt to be felt in a new appliance or method adopted for service on board ship. For, more than in any other branch of engineering work, it is important that power appliances placed on board ship, and especially on men-of-war, shall be capable not only of working satisfactorily when installed, but that their maintenance in an efficient condition can be readily accomplished by the ship's force available for the purpose.

"While a more extended use has been made of electrically driven auxiliaries on the Kearsarge and the Kentucky than on any other vessels of the navy up to the present time, attention should be called to the fact that the various types of electrically driven auxiliary machinery used on these vessels are the logical developments of generally similar types previously installed by the bureau of construction and repair on other vessels of the navy. Thus, for example, the turret-turning machinery may be considered a development of that which worked in so satisfactory a manner on the Brooklyn's 8-inch gun turrets during the late war with Spain; the chain ammunition hoists are the same in general principle as those used on the Puritan and many other vessels; and the extensive systems of blowers and exhausters used in the ship's ventilation are similar in character to those placed on the gunboats Nashville and Wilmington two years ago, and which to-day are giving eminently satisfactory results, both from the point of view of thorough ventilation of these vessels and ease of maintenance of the ventilation plant in an efficient condition. These instances of the satisfactory working in service of electrical machinery installed on vessels of our navy may not unfairly be taken as a reply to the question as to the possible doubt of maintaining in a constant state of high efficiency such an electric plant as that installed on the Kearsarge and the Kentucky. And it is to be hoped that the results obtained in service with the electric plants of these vessels may be such as to definitely lay the ghost of this doubt once and for all. For one of the most marked advantages claimed for the electric drive, namely, its efficiency in coal consumption, will increase with the size of the engines employed to drive the electric generators used, and the larger the number and collective power of the electric motors operated, the greater will be the opportunity to obtain such economy in coal consumption. As an illustration, on a battleship and an armored cruiser now building in this country for a foreign navy the electric drive is used for practically all auxiliary machinery, not only for the general service of the vessel, but for auxiliaries of the propelling machinery as well, with the result that the generating units are of such size as to permit of their being driven by triple expansion engines of the most efficient marine type, whose economy of steam consumption will unquestionably approach closely that of the main propelling engines."

Briefly stated, the electric plants of the Kearsarge and the Kentucky perform the following duties: The ship is lighted under peace and battle conditions; four search lights are operated; the Ardois signal set is operated for night signaling and also various means of interior communication within the ship, such as battle and range order indicators, electric propelling and steering-engine telegraphs, revolution and helm-angle indicators, etc.; truck lights and the ship's running lights are operated and

also the portable diving lanterns. The two turrets containing the 8-inch and 13-inch guns are rotated, the 13-inch guns elevated, ammunition hoisted for both 8-inch and 13-inch guns, rammers of 13-inch guns operated, and special ventilation provided to blow out gases out of bore of 8-inch and 13-inch guns. Ten endless chain ammunition hoists are operated, eight of them supplying the 5-inch broadside guns, and two supplying 6-pounder and 1-pounder guns on upper deck. Two winch type of hoists are operated, supplying ammunition to the 6-pounder guns in the after cabins. Six deck winches are operated—four winches of a simple geared type with friction drum suitable for quick hoists of moderate loads as in coaling ship, and two winches of a compound geared type permitting either the quick hoisting of light loads or heavy pulls at low speeds. The simple geared winches are especially designed for use as ammunition hoists to the military tops. Four boat cranes are operated, the boats being hoisted and lowered, and cranes rotated by power. The ship is ventilated throughout, including the engine rooms, by thirteen ventilating fans of which ten supply and three exhaust air for the various water-tight compartments. The centering device on the hydraulic telemotor used to control the steam distribution valve of the steering engine as automatically operated is also electric.

As the installation of these plants on board ship is only partially completed at the present time, it is impossible now, Mr. Woodward explains, to give the results of tests, and the efficiencies obtained on the tests of the various auxiliaries will have to be given later, either as an appendix to his paper, if the data can be collected before the volume of the transactions goes to the printer, or made a matter of subsequent communication to the society. The description of electric deck winches, boat cranes, ventilating fans, turret-turning machinery, etc., which the paper contains is most exhaustive, and is accompanied by page after page of clear illustrations. Space may be found in some future issue for the reproduction of a large part of this valuable information.

DISCUSSION ON ELECTRICALLY DRIVEN AUXILIARIES.

Charles J. Dougherty, mechanical expert at the yard of the Wm. Cramp & Sons Co., Philadelphia, referred to the fact that a foreign nation is having built in this country, at the present time, vessels which are in some respects in advance of any of our own in the matter of electrical equipment. He thought, however, that it would be well to see how the battleships Kearsarge and Kentucky work in actual service before adopting the system installed thereon as a standard for other vessels.

Capt. W. G. Randle told of the experiences of the International Navigation Co. with electrical apparatus, and declared that in his opinion it was a grave mistake to locate dynamos in the vicinity of the boilers, as has been done in the case of the Kearsarge and Kentucky. He cited instances illustrating the trend of currents from stern to bow and emphasized thereby the importance of having dynamos located in the after end of whatever compartment they might be placed in.

Mr. Dana Greene, manager of the General Electric Co., agreed that much depends upon the result of the performances of the electrical machinery on the Kearsarge and Kentucky, but he was confident that they will stand all tests. He realized that more electrical experts were needed in the navy but thought that this would be remedied in due course. After making a comparison between wires and steam pipes as a network of communication throughout a vessel, Mr. Greene said: "We all know how demoralizing the bursting of a steam pipe proves in time of war or peace. If an electric wire is severed, the auxiliary is disabled but the damage ends there. In addition the wire is much less likely to be hit than the pipe. I believe that for auxiliaries the advantage gained from a standpoint of economy is as two to one in favor of electricity. I am convinced, also, that the time is not far distant when we shall have a practical steam turbine and the vibration due to reciprocating parts will thus be eliminated. There are forms of turbines in this country which I feel justified in predicting will be developed as a commercial success in the near future."

Mr. G. W. Dickie clearly indicated by his remarks his favorable regard for the electric drive. He thought that one form of motive power should be given universal adoption. He firmly believed that the time would come when no steam pipe would go outside the engine and boiler rooms, save to the dynamo room. There was no doubt, Mr. Dickie said, of the successful use of electricity for the operation of steering gear and windlasses. He had recently sent to the navy department the design for an electric windlass. Continuing, Mr. Dickie said: "I think the time will come when it will be possible to operate generators by steam turbines, but that time has not come yet. I have always urged economic engines for auxiliaries, because they run oftener and consume, in the aggregate, possibly more coal than the main engines."

INCREASING COMPLICATIONS IN WAR SHIPS AND HOW SIMPLER ARRANGEMENTS MIGHT BE ADOPTED.

The contributions of Geo. W. Dickie, ship builder of the Pacific coast, to the proceedings of the society are always of a kind tending to create discussion. As a trip across the American continent is not a matter of a day's planning, and as Mr. Dickie is located at the Union Iron Works, San Francisco, he is not seen in the east as much as other builders of the ships of our navy, but a personal acquaintance with him is not necessary in order to understand that he is not a follower of the beaten path. Several papers submitted to the society since its organization settle any doubt that might exist on that score. This year Mr. Dickie writes of the "Increasing Complications in War Ships and How Simpler Arrangements Might be Adopted." Alike to most of the builders of ships, both for the navy and merchant service, he would, if he had his way, often make radical changes in the requirements that are laid down in specifications.

"Besides the every-day experience I have with this subject referred to in this paper," says Mr. Dickie. "I find, from conversation with naval officers in every position of responsibility on vessels, that the increasing complication and multiplying diversity of function sought to be reached by mechanical contrivances has become a positive dread to the officer who is held responsible for it all operating in the proper way, and at the proper time, just as its designer said it would do if kept in proper order. I believe that the present complicated condition on war vessels, generally, is the result of two causes: First, uncontrolled growth of new devices for doing the many things for which mechanism is required on these vessels, without the new devices being considered reliable enough to supercede the old. Hence, duplication, and, in many cases, triplication of apparatus for doing one thing, for which one good device alone should be used. Second, the system of divided control over the work, rendering it impossible to have a homogeneous design to begin with, that would enable the ship and all that is required of her to be treated as one machine, and provision made at the start for every function being considered with relation to every other function. It is not my purpose to propose any system of management in the construction of ships for the navy, but simply to record in the transactions of this society certain ideas that have occurred to me in my struggles with the tangled-up condition of things that prevails towards the completion of a modern warship. In hunting for a right of way for a steam pipe here or a water pipe there, against the claims of an electric conductor, a speaking tube, or, worse still, a bracket or bulkhead stiffener, that, according to the naval constructor, cannot be in any way interfered with, I have often thought that there might be some place in such a vessel, selected near the central axis of the structure, that would be so removed from the possibility of partaking in any structural damage by stranding or collision, and so protected by the armor from the possibility of damage in action, as to be perfectly safe without division by water-tight doors; and with such a spot in the cross-section of the ship for its center, I would construct a tunnel or passage extending without obstruction from the chain lockers forward to the steering room aft, that would be the spinal cord of my fighting machine, and from that I would deliver to every compartment of the ship that needed it, by lateral branches only, light, heat, power for auxiliaries, air, and orders of every description.

"I will treat the idea broadly, in its main features only, and in relation to the modern battleship, the complication being greatest on the largest ships. In working out the idea of a distributing passage, I find that the proper place for such a passage is in the center line, immediately under the protected deck; the passage to be 4 feet wide and 11 feet high. The floor of the passage would make the horizontal stiffening necessary for the center line bulkhead, which would be of the usual construction, from the inner bottom to the floor of the passage. The room required is not so great as it appears to be. Center line bulkheads, when unsupported between the inner bottom and protected deck, as they must be in engine and boiler compartments, need considerable depth of stiffening girders to stand the head due to the water on one side. In the Wisconsin, 15 inches of girder depth was required on each side, making the bulkhead 2 feet 6½ inches thick; so that a 4-foot passage, whose floor forms the stiffening required, does not require so much room, after all."

Following this general statement of the plan of a proposed central working passage, Mr. Dickie presents several drawings and goes into considerable detail as to the arrangement of a drainage system, complete water works for water service of all kinds, light and power transmission (the latter outside of engine and boiler compartments), as well as ventilation (cooling and warming), means of interior communication, etc. Mr. Dickie said that in advocating the adoption of such an arrangement he was aware that such a feature had already been used in battleships. The Royal Sovereign class in the British navy has a central passage extending through the middle part of the ship, and in height, from the inner bottom to the protective deck, and in this class of vessels there is no doubt that several features mentioned are carried out. Yet, on the vessels, referred to, the central passage is more of an ammunition passage than a sub-way for the distribution of the necessaries of life to the ship. "I believe," he said in conclusion, "that complicated as the arrangements on a modern battleship must be, a very great improvement in effectiveness and simplicity can be effected by blotting out many things that have survived their usefulness, and straightening out others that cannot as yet be dispensed with."

The discussion of Mr. Dickie's paper was opened by Mr. F. B. King, who favored uniformity of construction. Taking the Ericcson monitor as a text, he referred to the "complex time-consumers which all branches of the department now combine to include in a modern battleship." He favored rapidity of construction as a fundamental feature.

Naval Constructor Bowles was not in sympathy with some of the opinions expressed regarding the monitor, and he denounced as an ev'l emergency ship building. The subject of the simplification of the battleship and the lessening of the cost he had much at heart. He declared that we are running riot in the expense of vessels and the expense of maintaining them.

PAPERS READ BY TITLE ONLY.

With the close of discussion on the subject of Mr. Dickie's paper, the hour was growing late and the paper on "Beam Formulae Applied to a Vertically Stiffened Bulkhead, with Some Results" was read by title only.

This contribution to the proceedings of the society—by Mr. H. F. Norton, member—was of a mathematical kind. Last year Mr. Woodward presented to the society a paper describing the test of a large and important bulkhead, stiffened with vertical stiffeners. In order that a more intelligent idea of the reasons for the action of the bulkhead under test might be obtained, a mathematical analysis of vertically stiffened bulkheads under water pressure was worked out. The process followed and the results obtained, as applied to this bulkhead, were deemed of sufficient interest to be presented to the society at this time.

The paper dealing with the sheathing of the naval cadet ship Chesapeake was also read by title only.

At the last meeting of the society plans for the sheathing of the U. S. S. Chesapeake were presented. The Chesapeake is a practice ship for the United States naval academy, built by the Bath Iron Works of Bath, Me. In this paper Naval Constructor Lloyd Bankson told how the work was done. The paper was interesting, as the sheathing of steel vessels with wood is rather a new subject in this country, from a practical standpoint. The specifications given in the paper, noted the principal requirements in regard to planking and fastening. Constructor Bankson noted also practical points of interest that were encountered in the work and gave weights of materials, surface sheathed, time consumed, tests of materials, etc.

SECOND DAY'S SESSION.

GENERAL INTEREST IN THE SHIP BUILDING PRACTICE OF THE GREAT LAKES—CRANE APPLIANCES AT THE UNION IRON WORKS, SAN FRANCISCO.

The morning session on Friday, Nov. 17, opened with the reading by Mr. W. I. Babcock of Chicago of his very interesting paper on "Systems of Work in a Great Lake Ship Yard." This paper is printed in full elsewhere. No paper presented during the entire meeting engendered more general interest. Mr. Babcock was asked many questions regarding particular points of practice in the yards on fresh water. "Those of us who have to do with the building of warships at home and abroad," said Naval Constructor William Baxter of the Mare island (Cal.) navy yard, "are more or less familiar with great lake ship building. We get all the wrinkles we can from the lake builders."

Mr. G. W. Dickie said that the lake system of ship building was certainly startling to people unfamiliar with it. He had believed for a long time that many of the innovations in lake craft should be established in ocean vessels and could never understand why they had not been. Another matter of interest to him was that it should be possible with vessels of 400 feet length to have 288 feet in one mould. He did not see, he said, why this should not prevail in sea vessels, but the builders have not as yet been able to do it. Mr. Dickie also read a communication that had been placed in his hands by his brother, Mr. James Dickie, superintendent of the Union Iron Works. It was in part as follows:

"I have read with a great deal of interest Mr. Babcock's able and instructive paper and my only regret is that we who are on the coast cannot build ships quite as much on the factory principle as they do on the lakes. First, in large vessels that go on long voyages the engine cannot be put in the stern, for the reason that a vessel which uses from 1,000 to 1,500 tons of coal on a voyage would be very much down by the stern when leaving and very much down by the head on arrival, unless half of the coal were stowed in the forward end and some mechanical conveyer used to bring it aft to the boilers when required. The cost of this would, of course, be greater than the advantage. Oil vessels are usually built that way, but the nature of that cargo makes the matter of trim a very simple problem. Second, it is not advisable to make an ocean going steamer with so long a straight body and full ends. Third, vessels with the engines near amidships should have enough rise of floor so that they can be drained properly, otherwise there is always a large quantity of water left in the tanks, which is unnecessary weight to carry. In regard to the method of getting out work, it may be said that we use very much the same system with the difference that we use battens and gauges wherever we can and templates instead of moulds—our templates being from 1-8 to 3-16 inch thick—and instead of boring the templates we drive the center-punch through them and center all our holes, using a center on the punch, which makes much more accurate work, and I think on the whole is cheaper. When over in Europe three years ago, and going through one of the yards with the manager, he remarked: 'We punch very rapidly here, forty holes per minute.' I watched very closely and saw that the puncher sometimes would nearly hit the mark with his punch. I said to the manager: 'That bar is almost spoiled; there is not half a dozen good holes in it. Where are you putting those frames together?' We went to look at them. When he saw them he took off his hat and swore. I thought while our centering was a little slow it was the cheapest. (We do very little reaming.) We built eleven barges at one time to be shipped foreign. We got out all the material from patterns and templates and only put one together to try it. The remaining ten were put together at their destination. We were informed that they went together very nicely. In the battleship we are now building, the Ohio, all the keel, vertical and flat, all the longitudinals, the armor shelf and all the interior bulkheads were gotten out and the vessel put together using the longitudinals instead of ribbands for frame spacing and for the bulkheads to regulate the transverse shape, and we always find when work is laid out that it comes much more accurate than building the vessel by piecemeal. We find no difficulty in laying off the bilge plates, and prefer it to using a template, as the difference of length of the outside plate at the butt lap is much easier to calculate than to get it with a template from the work."

Mr. R. L. Newman of the American Ship Building Co., Cleveland, said he had often thought the strain on the tank of the lake carrier was excessive. Mr. Geo. W. Dickie asked about the manner of carrying water ballast in lake ships. Mr. Babcock replied that the practice now in vogue had been followed for many years, although it was not one that he entirely approved of by reason of the danger that when the bow of a vessel rises and the stern falls the rush of water backward might carry away the engine bulkhead. There is, however, less danger in long ships, he stated, since the long ships do not pitch nearly so much as the short ones as they extend over a greater length of sea. As far as rolling is concerned, he was of the opinion that the ships are so strong that free water makes them easier than otherwise.

In conclusion Mr. Babcock said: "Up on the lakes we are not especially bothered by precedent. The people up there if anything new occurs to them, believe in trying it whether anybody else ever did or not. I surprised an Englishman who the other day visited our yard and found fault with everything, by telling him that we didn't care how they built ships in England, as we built them for our own business. It is these facts which make the lake ships without a peer anywhere for the special conditions for which they are fitted."

The discussion regarding lake ships gave Col. Stevens the text for some very interesting remarks about the growth of American ship building. He said there was no doubt but that the distinctively American method of building merchant ships had been originated on the great lakes, and thought the lake ships indicated most strikingly that the builders were experts on the question of "where to slight the job." "I never found anywhere," said Col. Stevens, "any figures per ton mile for the movement of freight that will compare with those reported from the lakes and I understand that these figures are not faked."

OVERHEAD CRANES, STAGING AND RIVETER-CARRYING APPLIANCES.

The next paper on the programme was that dealing with "Overhead Cranes, Staging and Riveter-Carrying Appliances for the Ship Yard."

Mr. James Dickie of the Union Iron Works describes in this paper the framework used in the construction of vessels at San Francisco. At the San Francisco yard the framework covers the entire vessel while building. Four slips are covered in this way—three of 300 feet length and one of 408 feet length. The system is practically the same as that adopted by Swan & Hunter on the Tyne, excepting that the San Francisco structures are of timber while that at Swan & Hunter's is steel. Mr. Dickie refers to the cantilever traveling cranes at Newport News, to the overhead crane or gantry so much used on the great lakes and to the large gantry at the works of Harland & Wolff, Belfast, but says that none of these perform all four of the essential functions carried out in the kind of structure that is used at San Francisco and at the works of Messrs. Swan & Hunter in England. The four functions referred to by Mr. Dickie are: Hoisting and depositing material in any position; provision overhead for power riveting, now coming so generally into use; staging necessary for the construction of the vessel, which is an important item when provided separately; necessity of keeping upper works fair while in early stages of construction. Space will very probably be provided later on for more extended reference to this paper and for reproduction of some of the drawings.

Discussion of this paper was opened by President H. G. Morse of the New York Ship Building Co., who made a few remarks regarding the types of crane employed at the Cramp and Newport News yards, and which have been described several times in these columns. Mr. John Platt explained that the monster gantry at the yard of Harland & Wolff, Belfast, was primarily a riveting gantry and was not designed for handling material. Naval Constructor Bowles said he believed that the scheme illustrated in Mr. Dickie's paper was the best in existence.

HICHBORN VS. MELVILLE.

BUREAU CHIEFS ENTER INTO A SPIRITED DISCUSSION RELATIVE TO THE NEW DENVER CLASS OF CRUISERS AS COMPARED WITH THE CINCINNATI AND RALEIGH.

Rear Admiral Hichborn, chief constructor of the navy, usually contributes to these meetings the latest designs of vessels for the navy. This year he presented to the society a description of the sheathed protected cruisers—Denver class—provided for in the last appropriations for increase of the navy, together with the general plans, a statement of the general characteristics, weights, etc. The Denver class of vessels was quite fully described in the special naval edition of the Review, published a few weeks ago. In presenting this paper, Admiral Hichborn took occasion to refer to published statements relative to the cruisers built for the Brazilian government and purchased by the United States just prior to the outbreak of hostilities with Spain. He said: "So much has been published about these cruisers that I cannot refrain from presenting a few facts—principally because the published statements have been used for the purpose of making unfavorable comparisons with our new designs. One of these publications, for instance, in a scientific paper, contained cuts of the vessels, with certain particulars headed, respectively, 'the 3,500-ton protected cruiser New Orleans' and 'the proposed 3,500-ton semi-protected cruiser Denver and class.' It takes but a glance to discover the first gross error in this comparison, for those familiar with the facts—the New Orleans having left the New York yard a short time ago, in ordinary full load condition, displacing over 4,000 tons. Under exactly similar conditions, the Denver and class will displace only 3,500 tons, and at this displacement the actual weight of ammunition carried and the actual weight of stores aboard will be greater than in the case of the New Orleans at 4,000 tons. Moreover, the coal will be practically the same, for the Denver will stow and carry 700 tons readily on 3,500 tons displacement, while the most that has ever been in the New Orleans' bunkers, as far as is known—and certainly what was in her bunkers when displacing the 4,000 tons referred to above—was less than 750 tons. I do not pretend to criticise the design or construction of the New Orleans, but she is essentially a 'show' vessel, cleverly designed to that end, but not such a design as would be found emanating from the British admiralty or from our navy department. Briefly stated, she was designed purely for speed and the heaviest battery the law would allow. With her extra length of about 50 feet she will not maneuver as well as the Denver class; with her extra draught of about 3 feet she is considerably handicapped for work in shallow harbors; with her heavy battery (of little advantage, considering the small amount of ammunition carried) she could not stand the weight of a flush upper deck, and even without it her top weights are such that, particularly without the water-line protection of cellulose provided for the Denver class, she is not nearly so well prepared to stand punishment as will be those vessels. Her powerful machinery and large battery necessitate a crew out of all proportion with the accommodations provided, and considerable objection has been filed, by those connected with the ship, in regard to the unsatisfactory provision for officers and crew, including boat capacity for very little more than half the number. Her auxiliary appliances for lighting, heating, refrigerating, etc., were, in some cases, omitted in the original design, or were meagre and unsatisfactory, and have had to be added since, with increased weight. There are different standards for comparison in cases like the one in point, and facts, even may be distorted so as to delude the unpracticed reader. The article I have referred to, in addition to being not entirely correct, was very misleading, though probably not intentionally so; some of the original information, relative to the New Orleans, published in the annual report of the bureau of construction and repair for last year having itself been found since to be not entirely correct. There is also room for considerable differences of opinion in determining the elemental characteristics of a design. Personally, however, I believe our experience with the Cincinnati and Raleigh was a sufficient illustration of what to expect from crowding machinery and battery into a small cruiser at the expense of cruising efficiency. I predict great usefulness for the Denver and class, as well as considerable popularity among sea-going officers."

A part of Admiral Hichborn's paper other than that above quoted

was also the cause of a spirited reply from the bureau of steam engineering. It was the following more specific criticism of the Cincinnati and Raleigh: "The chief characteristics of the design for these cruisers (Denver class) were settled and approved by the department before the final preparation of the general plans. These characteristics show the vessels to be about the size of the Raleigh and Cincinnati, which, though they have been classed as 19-knot vessels, with more than double the horse power of the present designs, have never been able, owing to certain well-known conditions, to maintain a speed even approximating to the rated 19 knots for any length of time. The Raleigh, when with Dewey's squadron, was only able to steam, with difficulty, at a speed of 9 knots, using three-fifths of the boiler power. The coal supply of these vessels was also limited, and the coal consumption was a serious question when making passage between distant ports. In the new designs a liberal allowance has been assigned to all the principal weights, and there has been no attempt to secure 'fancy' results, either on paper or on trial. They have been designed for hard service, and the offensive and defensive properties, suitable speed, durability, habitability, etc., were carefully considered in determining their characteristics. Owing to the nature of the service which they were likely to perform independence of coaling and repair stations, as far as possible, was believed to be an important consideration. In view of the fact that the vessels were to be sheathed and coppered, and that the machinery was to be liberally proportioned, a speed of 16½ knots, as representing the capacity of the vessel at all times, was considered sufficient, and easily places the ships in the class with our earlier vessels making 19 or 20 knots on a forced trial with clean bottoms. The coal supply is represented by a bunker capacity of 700 tons, which is sufficient to give them a radius of action at full speed of nearly 2,500 knots, and at the most economical rate of steaming—probably in the neighborhood of 10 knots per hour—they will be able to steam about 7,000 knots without re-coaling. This would cover a continuous trip from San Francisco to Manila. As previously stated, a liberal allowance has been made for machinery weights, the engine-room weights per indicated horse power being about 10 per cent. heavier than is the case with the Raleigh or Detroit classes. The total machinery weight is somewhat reduced, proportionately, by the use of water tube boilers and high pressures."

ANSWER OF THE ENGINEER-IN-CHIEF TO THE CHIEF CONSTRUCTOR.

The reply of the engineer-in-chief to Admiral Hichborn was read by Mr. McFarland, and was as follows:

"Notwithstanding the published adverse criticism, I do not think it at all necessary for the chief constructor of the navy to defend the plans for the new ships of the Denver class, as the vessels are designed for special patrol duty and the board of construction had full knowledge of the needs of the department when the principal characteristics were agreed upon. In the case of the Raleigh and Cincinnati, however, I hardly think the statement contained in this paper, namely, that 'though they have been classed as 19-knot vessels with more than double the horse power of the present designs, have never been able, owing to certain well-known conditions to maintain a speed even approximating to the rated 19 knots for any length of time' is a fair one, and I may be pardoned for directing attention to certain facts which at least greatly modify the inference it embodies. It will be recalled that when these ships were offered for public bids there was not one made within the limit of the congressional appropriation. For that reason the department decided to undertake the work in the navy yards—one hull at New York and the other at Norfolk, and the machinery for both at the navy yard, New York. Neither of these vessels after completion underwent the full power tests, such as would have taken place had the ships been built by contract. The nearest approach to such a trial was in the case of the Raleigh, which ship, after having been in commission about two years, and without much particular preparation ran a four hours' test (March 25, 1896) with her regular crew. The wind and other conditions on this occasion were unfavorable, and furthermore, the trial took place in comparatively shallow water, ranging during the first two hours from 14 to 17 fathoms, and at no time exceeding 25 fathoms. Under these circumstances the best results as to speed could scarcely be expected, but nevertheless on a displacement of 3574 tons the average speed obtained was 18.64 knots, while during two hours of the trial the average was 19.27 knots.

"Captain Miller, the commanding officer, makes the following interesting comment on closing the report of this run. 'While it is to be regretted that the conditions of wind and weather were not more favorable, the general results of the trial are gratifying. At the close of the trial, with the exception of the middle fire room blower, everything was in good working condition. Very few men in the force had ever had any experience with firing with forced draft and the coal was the run of the mine. It is fair to conclude that the ship will readily make, under the ordinary conditions of service at sea, the designed speed, and that she will with favorable conditions exceed it.'

"From the above and bearing in mind that the Raleigh was fully loaded, displacing about 400 tons more than her designed draught the showing is not altogether bad.

"The chief constructor also states 'that the Raleigh when with Dewey's squadron was only able to steam with difficulty at a speed of 9 knots, using three-fifths of the boiler power.' When it is remembered that the Raleigh had not been docked for about seven months previous to the battle of Manila, and that in consequence her bottom was very foul the speed was thereby necessarily materially diminished. The chief engineer of the ship, however, in an official report, submitted by order of the commanding officer after the fight, makes this significant remark: 'The speed in action was variable, but was not great enough to cause any difficulty in keeping up steam.'

"As the Raleigh has recently returned from Manila it may be of interest to quote from the official records, as to the speed, on her return trip, under the approximate three-fifths boiler power alluded to. On the trip from Bombay to Aden, a distance of 1642 knots, and with a slightly less boiler power than in use during the Manila fight, under natural draft in a tropical climate, and with no special effort to make time, an average speed of 13.14 knots was maintained. After arrival at Aden there remained sufficient coal for 928 knots, or an endurance of 2,570 knots at the speed mentioned. Leaving Aden an average hourly speed of 12.78 knots is recorded for about the next 1,300 miles, with the same boiler power in use. These runs are not cited as fancy figures but simply as indicating what the ship has done under ordinary conditions. An examination of the steam log book discloses the fact that ordinarily and for economy in coal consumption the Raleigh's speed in cruising did not usually exceed 12 knots and generally was below that figure. Many instances are recorded, however, where the speed was materially greater, and on one occasion (Oct. 12-13, 1896), during a trip between Hampton Roads and Smithport, N. C., when speed was apparently important, an hourly average of 15.6 knots was maintained for sixteen hours under natural draft with about five-sixths the boiler power.

"The above data I am glad to present, not in defense of these two vessels, but rather as simple facts deemed no more than fair to make public in connection with this interesting paper, in order to present the pros as well as the cons. That the internal arrangements are far from ideal, is well known, as stated forcibly by the author, and the lessons drawn have been valuable to designers of hulls as well as machinery. It may not be irrelevant here to note that during the early stages of the design I persistently called the attention of the then chief constructor of the navy to the great desirability and importance of increasing the length of these ships by about 15 or 20 feet, in order to give ample room for the efficient operation of the machinery and especially to provide fire room of proper proportion. I regret that this was not done, but as it was not there can be no better result from the expensive experiment than to adopt its lessons and include as a primary requisite in the planning of our ships the allotment of such ample space for the motive power as will enable it to be operated under all conditions with that efficiency so successful to the success of the design. I am still firmly of the opinion, even at this late day, that the cutting in two of the hulls of these two ships, and lengthening, say 20 feet, would contribute to make them far more serviceable and would have results as beneficial as was shown in the cases of the Castine and Machias, where the same expedient was so successfully adopted."

Mr. G. W. Dickie said he thought naval architects generally were thoroughly in accord with the department plans. He was sorry, however, to see the suggestion of such soft wood for sheathing. He preferred teak.

Naval Constructor Bowles said that he had always been opposed to wood sheathing for steel ships. He deemed it unnecessary, undesirable, expensive and dangerous. He admitted that there might possibly be need of a few sheathed ships in the Philippines until a dry dock could be provided there.

NOVELTIES IN SHIP FITTINGS.

Assistant Naval Constructor R. M. Watt, stationed at the Brooklyn navy yard, described in this paper some of the improvements and developments in the fittings of naval vessels which have been systematically carried on in the construction and repair department of the Brooklyn yard under the direction of Naval Constructor Francis T. Bowles. He described first a water-tight bulkhead door operated by electric power, which is always under control by hand or power at the door and capable of being closed by power from any selected distant station. The paper also described and illustrated a non-conducting, non-inflammable, non-splinterable sheathing for use on the sides of steel ships in living quarters, and a metallic folding berth for ships' staterooms, as well as a water-tight metal skylight for use over messrooms and staterooms. Constructor Watt said of the non-inflammable sheathing for living quarters:

"The lesson of the Chinese-Japanese war for the naval architect was the danger of destruction of war vessels by conflagration in action. If further proof were required as to the absolute necessity for discontinuing the use of all combustible material in the construction and equipment of war vessels, it was abundantly furnished by the battles of Manila and Santiago. The official reports on the battle of Santiago state that the Infanta Maria Teresa, Almirante Oquendo and Vizcaya were destroyed by conflagration, caused by explosion of shell in the interior, which set fire to the woodwork. The strongest evidence as to the importance of this question, and likewise illustrative of the intensity of the fire, and the rapidity with which it spreads, is given by the fact that on these vessels men were driven from loaded guns, not by projectiles, but by conflagration. That conflagration is more destructive than gun fire was likewise emphasized by examination of the Spanish vessels after the battle of Manila. That the battle of the Yalu marked a step in ship building practice, which was fully appreciated by the naval architect, is demonstrated by a comparison of the living quarters in vessels finished as recently as five years ago and those building or refitting now. Particularly in officers' quarters are the changes most noticeable. Six years ago the divisional bulkheads were of untreated wood; likewise the ceiling overhead, and the ceiling or sheathing against the side of the ship. The berths, lockers, and all the furniture, including a closed-in wardrobe, also the ship's ladders, shelving everywhere, etc., were of untreated wood. Now, the constant endeavor is to reduce woodwork everywhere to a minimum, steel or some other non-combustible material being substituted wherever practicable, and where wood is used at all it is required to be subjected to an approved fireproofing process. The present practice at Brooklyn navy yard is as follows: The unnecessary overhead ceiling is altogether omitted. In crew's quarters the outboard sheathing is omitted, but in officers' quarters asbestos sheathing is fitted. All divisional bulkheads are built of light corrugated sheet metal (first fitted on the Texas in 1892) and finished with a sheet-metal cornice (first fitted on the Atlanta). The uncleanly wooden berth is replaced by a compact and cleanly metal folding berth. The wooden ladders are altogether done away with, and metal ladders with some form of non-slipping tread are in general use. For the unsatisfactory wooden skylights over mess-rooms and inboard staterooms a water-tight metal skylight is substituted. At the present time the desks, chairs, tables, and chiffoniers used on naval vessels are made of fireproof wood; but samples of metal furniture, by which the use of wood for this purpose will be entirely dispensed with, are now being prepared at the Brooklyn yard for the purpose of selecting types for naval use. All lockers supplied to the Atlanta, including rifle lockers, petty officers' lockers, and marines' lockers, are of metal, and the Atlanta's cabin has been fitted with a metal roller-top desk

"A non-conducting, incombustible, splinter-proof covering for use in living spaces on the inside surface of the outer shell of steel vessels, and for magazines, coal-bunker, and boiler-room bulkheads, has been developed in conjunction with the H. W. Johns Mnfg. Co. of New York. The wooden sheathing or panelling at first used in such places was replaced because of its combustible qualities by a light steel sheathing which has been a source of constant complaint of discomfort and danger to health. Because of the numerous complaints, the asbestos sheathing was developed to meet the objections to both steel and wood sheathing. This it fully does. The finished sheathing possesses the primary requirements of a non-conducting, incombustible, splinter-proof covering; it is light in weight; in appearance it is clean, neat, and ornamental; further, it adds to the comfort and habitability of living spaces, being warm in winter and cool in summer. The total weight of the completed sheathing, including framework and fastenings, averages 6½ pounds per square foot. The work was in such condition as not to allow of temperature experiments during the extreme heat of summer, but data taken during the mild heat of September show that the effect of the sheathing on the side of the ship exposed to the direct rays of the sun was to reduce the temperature from 20 to 35 degrees Fah. After various trials, the following method of fitting has been adopted as the most satisfactory: Between the ship's frames, or bulkhead stiffeners, and 1½ inches from their inner edges, is fitted a framework of 1 inch by 1 inch by 3-16 inch steel angle bar horizontally, and 1 inch by 3-16 inch flat bar vertically, so spaced as to provide the necessary stiffness, and to carry bolts which extend to secure the finishing mouldings. Over this framework is drawn No. 19 galvanized iron wire cloth, ½-inch mesh. Over the wire cloth, asbestos fire felt (a very light porous asbestos) in sheets 1½ inches thick, is secured by galvanized sheet iron or wire cloth washers and copper wire. This fire felt is flush with the surfaces of frames, or edges of angle bars. Asbestos millboard, ⅜ inch thick, is placed over the fire felt to secure a smooth, hard finish, and is held in position by galvanized iron mouldings, ⅜ inch thick and 1½ inches wide, set up by countersunk nuts on the bolts carried by the inner frame. At the proper height is also a galvanized sheet iron chair rail, 4½ inches wide. All interstices around air ports and elsewhere are filled in with asbestos cement. The millboard is coated with sizing to prevent absorption, and then painted with white enamel and gold striped resulting in a pleasing and symmetrical panel effect. The finishing mouldings come over the seams of sheets, and the size of panels must therefore be considered in connection with the commercial sizes of asbestos fire felt and millboard sheets. This asbestos sheathing has been fitted around the engine-room trunk in junior officers' quarters on the New York; in the ward-room of the Indiana, where it was fitted in portable sections in the ward-room and certain staterooms on the Massachusetts; and in officers' quarters on the Atlanta and the Cincinnati, where the method of fitting is as above described. In the Atlanta's cabin, the outboard side and the under side of the turtle-back deck over the cabin have been sheathed as explained, while for the other bulkheads asbestos millboard only has been used."

A representative of the W. H. Johns Co. added some detail to what Constructor Watt had said regarding the use of asbestos in living quarters. His firm has been at work along this line for two or three years past. Mr. W. B. Cowles, formerly of the navy but now promoting the Long-Arm system of bulkhead doors, made a few remarks along lines suggested by the description of the electric bulkhead developed by Naval Constructor Bowles at the Brooklyn navy yard. He was of the opinion that compressed air is superior to electricity for the operation of bulkhead doors, especially where the plants are of more than five doors.

PROGRESSIVE SPEED TRIALS OF THE U. S. S. MANNING.

This was a report of a set of progressive speed trials of the revenue cutter Manning, made in June last over the measured mile maintained by the Bath Iron Works at Southport, Me. A party for taking observations during the tests was made up at the Massachusetts Institute of Technology, consisting of Prof. C. H. Peabody, author of the paper, Mr. C. H. Clark, instructor in naval architecture, Mr. J. C. Riley, assistant in marine engineering, and Messrs. Loomis, Newell, Pierce, Riddle and Trask, graduates from the course of naval architecture at the institute. Observations taken were the times required to pass over the mile, revolutions and power of the engine, steam pressure and vacuum and the form of wave profile. The Manning is a vessel of 205 feet 6 inches over all, 188 feet between perpendiculars, 32 feet moulded beam and 12 feet 4 inches draught (on trial). Her displacement was 1,000.7 tons. She has triple expansion engines of 25, 37½ and 56¼ inches diameter and a common stroke of 30 inches; wheel, 11 feet diameter and 12 feet 4 inches pitch. A speed of 16 knots was obtained with natural draft at 152 revolutions, the engines indicating 2,181 horse power.

TACTICAL CONSIDERATION INVOLVED IN TORPEDO BOAT DESIGN.

Although the session was waning, considerable interest was manifested in the paper contributed by Lieut. A. P. Niblack. Lieut. Niblack was one of the principal contributors to the torpedo boat discussion at the last annual meeting, and some appreciation of his devotion to the subject may be gained from the statement, made at the meeting, that the present paper was written while the author was watch officer on a war vessel at Manila during the rainy season.

This paper will very probably be published in full in a future issue of the Review. Lieut. Niblack says that the craze for great speed in torpedo boats is illogical and tactically it is indefensible. Back of it is generally an advertisement for somebody. People who handle torpedo boats have never sanctioned it. What they do ask is that boats be built in groups on identical designs, and that every reasonable effort be made to standardize fittings. As long as fittings are standardized, he says, we may improve groups progressively from year to year as experience dictates. He gives the following as desirable characteristics of a first-class seagoing torpedo boat:

(1) It should be as small as is consistent with sea worthiness, so as to offer as small a target and be as little visible as possible, and, at the same time, should offer a reasonably stable platform for its torpedo tubes.

(2) It should be designed to have as small a bow wave as possible; its machinery should be as nearly noiseless as practicable; and it should not show flames or smoke from the stacks.

(3) It should have a large fresh water tank capacity and be fitted with two smaller evaporators and distillers in preference to one larger one.

(4) It should have a reasonable bunker capacity. If for coal, the design should have in view the future use of liquid fuel.

(5) The efficiency of the boat depending so largely upon the physical condition of the crew, habitability should receive due consideration in the design.

(6) Speed is not essential, although desirable, but a moderate reliable sea speed, obtained without forcing and without noise, flame, and vibration should be striven for.

FIRST-CLASS SEA-GOING TORPEDO-BOATS OF SEVERAL NAVIES.

COUNTRY.	Date.	Where or by whom built.	Length (ft.)	Beam (ft.)	Draught (ft.)	Displacement. (tons.)	I. H. P.	Number screws	Extreme speed (knots.)	Complement.	Coal (tons.)
Austria	'95	Yarrow	147.5	14.7	6	107	2000	1	24	26	30
Denmark	'93	Copenhagen	140	14.3	7	114	1300	1	22	24	25
France	'92	Gruville	147.5	14.5	5	114	1550	2	24	34	20
Germany	'92	Schichau	144.4	16.5	7	110	1500	1	24	24	30
Great Britain	'87	Yarrow	135	14	6	105	1540	1	23	21	30
Italy	'97	Italy	135	14	5.3	110	1600	2	25	20	30
Russia	'91	Russia	128	15.7	6.9	98	1250	1	21	13	17
United States	'96	Herreshoff	139	15	4.1	103	1750	2	22.5	26	28
Approximate average	'93		140	14.8	6.0	108	1560	1.4	23.2	23	24

"The foregoing table," says Lieut. Niblack, "shows the principal characteristics of a certain number of seagoing torpedo boats of several countries, selected to correspond to a displacement of about 100 tons, but not as representing the standard type, although it may reasonably be assumed that any given boat represents the best at a given date of building. The 'approximate average' is, of course, somewhat misleading, but is suggestive. As regards twin vs. single screws, it does not prove much. Both the draught and speed of the Morris are greater than given officially, although draught up to a certain point is a matter of little importance, since it is unsafe to fire a torpedo in less than 30 feet of water, owing to the possible initial dive. For canals 6 feet is not too much. It is estimated that for a boat of about 110 tons displacement it will require about 1,550 horse power to drive her 23 knots, and 3,100 horse power for 30 knots; in other words, about twice as much. Of course a great deal depends upon the design of the boat. Since 1893 the size of torpedo boats has increased very considerably, as in France, where the latest type is 150 tons and 4,200 horse power, with 30 knots speed; Germany, 140 tons displacement, 2,500 horse power, and 25 knots; and Italy, 150 tons, 2,700 horse power, and 25 knots.

"In conclusion, let it be understood that real progress is just as admissible with standardized fittings as with chaos. We can also learn several lessons from recent events. The Oregon and the Iowa gave a beautiful object lesson when they cut loose from a base in New York and reached, the one San Francisco, Cal., and the other, Manila, P. I., without having to rely on any supplies other than those they had in the auxiliaries accompanying them. Lieut. Com. W. W. Kimball. U. S. N., has proposed that we adopt for seagoing torpedo boats a similar scheme; that a certain number of boats in a group have as a base a large depot steamer to carry coal, liquid fuel, oil, water, waste, compressed air, spare parts, medical officers, relief officers and men, stores, supplies, repair shops, etc. This will enable us to shift the base from point to point, and make a fewer number of torpedo boats cover a wider stretch of coast. With such a long coast line as we have, we can never afford to have all the torpedo boats required. This would mean seagoing torpedo boats for coast defense, and second-class boats for harbor defense, which is technically correct. Torpedo boat destroyers, operating from a fleet as a base, would accompany said fleet wherever required to assist in protecting it from attack by the torpedo boats of the enemy; in other words, in operations on the enemy's own coast. This view of the use of destroyers and first and second class torpedo boats is in conformity with modern tactical and strategical ideas."

Mr. John Platt, who recently returned from a sojourn in England, during which he studied the torpedo boat question, stated that the whole development of recent years was, he thought, in the direction of larger boats suited for better service. He also called attention to the fact that in England the trials must be made on a given coal consumption and with the boats carrying a given load. He thought that service speed should not show a falling off from trial speed of more than 2 knots. He favored two types of boat, one for seagoing work and the other for harbor service.

Mr. G. W. Dickie believed that if a torpedo boat was built at all it should be built to go to sea in all sorts of weather conditions and accompany a fleet, and to that end it should have quarters in which the crew and officers could live comfortably. Naval Constructor Capps was in favor of moderate speed and more boats. He wanted to see torpedo boats of increased strength and advocated two classes of 100 and 500 tons displacement respectively, for harbor and deep sea work. He was also in favor of providing large capacity for fuel and water.

Mr. McFarland said it was unfortunate that the torpedo boat was desired to do such a variety of things. It was like endeavoring to combine the qualities of a race horse and a roadster. What ought to be done, he said, was to determine the type of boat really wanted and then stick to the policy adopted.

The program closed with the presentation of Prof. Durand's paper "On the Action of the Rudder," a technical contribution, after which a vote of thanks was extended to Rear Admiral Bunce. There was the unanimous adoption of resolutions of regret over the absence of President Griscom; of appreciation and recognition of the services of Secretary Bowles and of thanks to the Society of Mechanical Engineers.

On Friday evening the usual banquet was held at Delmonico's and was attended by more than a hundred members and their friends.

CAUSES FOR THE ADOPTION OF WATER TUBE BOILERS IN THE UNITED STATES NAVY.

BY GEO. W. MELVILLE, ENGINEER-IN-CHIEF, U. S. N.

It has been a number of years since I have had the honor and pleasure of addressing this society. Speaking generally, the progress and design of machinery of warships has been, during that time, along such well-developed lines, and so in accordance with the generally accepted theories of designers, that there has been little to say. More recently, however, in order to keep pace with the times and to cope with the necessity we have always before us of securing ships that will be in nowise inferior to those built for any other nations, a change in machinery design has been made that at first glance appears radical—the general adoption of water tube boilers for all new vessels of our navy. Elsewhere violent diatribes have been launched against those responsible for a similar decision, and I am aware that there exists a not inconsiderable sentiment in this country against water tube boilers. I call it a sentiment advisedly, because I believe that much of it is due to the attachment that engineers have for their old and proved friend, the cylindrical boiler.

Only a part of the opinions unfavorable to the change arises from the natural and proper conservatism of naval architects and marine engineers, but these demand answer. Flooded always with new devices—or rather by rejuvenated failures in new forms—we find a very small proportion that is even worthy of a trial, and where a new mechanical idea is tried on shipboard so much time is spent in adapting it to naval conditions and in repairing its failures that each of us becomes naturally and properly dubious when any change is suggested. Any important change in design, even of the apparently minor fittings of ships, may involve such risk to vessel and crew as to be unjustifiable, unless the device be thoroughly tried beforehand. Many apparently good ideas have given successful results on shore only to fail dismally at sea. I think that it may be given, as a general rule, that no change in design should be authorized that has not already been successfully made.

Of course a strict application of this rule would lead to stagnation. Here, however, enters the designer. His role is an important one. He has to cull the good points from previous work, and, if he be a good designer, he must also leave out the bad points. There always are some bad points, but amelioration of conditions should be the aim of naval designers. This implies that a good designer must be of vast experience and of extended observation. The larger his field of observation the more valuable his conclusions. It is the details that count. No man can succeed as a designer of warships without the most careful attention to small things. The modern battleship is a monument to the greatness of the minutiæ of design. It has been gradually built up from the sailing beauties of a century ago. Steps in advance have been slow, generally speaking. We cannot advance by leaps and bounds in marine work. Here genius is hampered by such conditions as make any step in advance a great achievement. Of course, we have the case of Ericsson and the Monitor, but this was a case not only of special conditions but also of a most exceptional man. Naval architecture is a pyramid, each stone of which is supported by all of the preceding ones. The size of the stone that one man can add to the pile depends, of course, upon his ability, but more especially upon his work. By hard work and by paying attention to what is going on around him any man can add his quota, but "those who, having eyes, see not; and who, having ears, hear not," are worse than useless.

NATURAL STEPS TOWARDS THE EVOLUTION OF A PERFECT FIGHTING MACHINE.

The task I have set myself to-day is no mean one. I desire to show that the decision to use nothing but water tube boilers in our future war vessels is a step in advance, and that it is a natural step towards the evolution of the perfect fighting machine. I desire to show that it is no radical change, and that it does not involve the use of anything but a tried, successful, and reliable apparatus that gives us positive and great advantages over the character of boilers heretofore generally used. I desire not to minimize the disadvantages following this change, but to show that these disadvantages are not only not insurmountable, but, for warships, they have already been overcome. In the first place, I want to state that water tube boilers are bad in principle. They carry the pressure inside their weakest parts—the tubes. A failure in a tube is followed by the opening of a fault, sometimes to a dangerous degree. In a fire-tubular boiler, on the contrary, the pressure would continue to close a split tube. It is true that a failure of a boiler tube generally comes from pitting, where fire tubular boilers generally have such a great advantage as in cases of split tubes. Yet failure of tubes is the most common defect in all boilers, and a proper design would place the pressure on the outside of the tube. Water tube boilers are, from their very definition, designed from a wrong principle, not only because of the direction of application of pressure upon the tubes, but also on account of the decreased amount of water in the boiler, of the increased difficulty of observing a leak, and of the decreased value of heating surface in water tube boilers. For this reason, as an engineer, it is with some misgiving that I state that I consider water tube boilers tactical necessities for warships. Builders of water tube boilers use solid drawn tubes almost exclusively for marine work. This, of course, decreases the danger of split tubes, but it does not change the mechanical principle. Some day, probably not in my time, we may hope to have a boiler having fire tubes and having the advantages of water tube boilers. Such a boiler would force its way at once into all navies, just as water tube boilers are doing at the present day.

Disbelieving, as I do, in the cardinal principles of water tube boilers, I have sturdily opposed their adoption by our navy until now I am convinced that they must be used if we are not going to content ourselves with inferior ships to those built for other nations. Of course, during the period of development of the design of water tube boilers, that even now continues, I have, in my official capacity, kept track of and taken part in the world-wide experiments with their use. Water tube boilers have advantages and I have never been blind to them. Two years ago I stated that their disadvantages had been sufficiently removed to justify their use on our warships. Now I consider that the value of their advantages has been sufficiently developed to necessitate their use if we do not wish to be left behind in naval design. The principal thing to which I desire to call your attention is the fact that all vessels are essentially compromises. Any ship must be considered in its entirety, and the advisability of a change in design of any part must be determined from its effect upon the ship as a whole. Whether or not water tube boilers are superior to cylindrical boilers as boilers simply, if there be a beneficial effect upon the ship as a whole due to the adoption of water tube boilers, these boilers are essential to the best design. The necessity of compromise in ship design must be self-evident to the members of this society who have the problem before them for solution almost daily. Taking the particular case of warships, the size of our ships is limited by their draught. We are building vessels now that are as large as any that can enter our harbors and docks, and we cannot, therefore, increase their power as fighting ships except by improvements in design. Any increase in weight allotted to one essential of the efficiency of the ship must be counter-balanced by a decrease in some other perhaps equally essential element. So far, this has most frequently been done by robbing the coal pile—an extra gun, a half knot in speed, or an additional inch in armor protection—each means a few tons less coal in the bunkers. I must except the more recent designs of battleships from the above general rules. The importance of coal endurance has become more and more manifest, and it has been appreciated fully in our recent designs. Incidentally, these last ships are fitted with water tube boilers. Water tube boilers are considerably lighter than those of the old type, and their effect upon ship design may be given as follows: Of two ships, having all other qualities identical, one fitted with cylindrical boilers and the other with water tube boilers, the latter will be somewhat the smaller and handier—will have somewhat less draught, and will cost less. Limited, as we are, in the size of our warships by their draught, I think that the foregoing shows that for a maximum of fighting efficiency we must use water tube boilers. The designing engineers of our naval vessels are limited in weight and space. They save little or nothing in space perhaps, but they save greatly in weight if they adopt water tube boilers. If these can be successfully operated on shipboard they must be used because of their decreased weight. The foregoing is entirely apart from any consideration of the relative merits of water tube and fire tubular boilers, but it is conditional upon the possibility of the successful operation of water tube boilers.

HISTORY OF THE WATER TUBE BOILER IN OUR NAVY.

Before considering claimed advantages and disadvantages of water tube boilers, I desire to give a few historial facts, most of them already well known to the members of the society. The old Martin boiler was the first water tube boiler ever used in any naval vessel. We had good success with these boilers, but they died out of use with the introduction of high-pressure multiple-expansion engines and the consequent cylindrical boilers. For years none but water tube boilers have been installed in our steam launches. These have always been attended by unskilled labor, yet the results have been very satisfactory. Some accidents have occurred, but they have been very few, probably no greater in number than if fire tubular boilers had been used, and it is to be noted that the results of a boiler explosion would probably have been worse in almost every case if the failure had occurred in a fire tubular boiler. Torpedo boats and destroyers in our navy have always, since the time of the Cushing, been equipped with water tube boilers of various types. Small bent tube boilers have generally been used. There have been some cases of sad accidents in the fire-rooms, generally due to carelessness in manufacture, and particularly in tube setting, but not to defective design. The boilers have proved to be quite as reliable as the extremely light engines of these boats. With the small amount of skilled attention it is possible to give torpedo boats, and considering the character of service demanded of these small craft, I think that no engineer will today question that the use of light water tube boilers, with the higher speeds possible as a result, adds to their efficiency and security. I think even Herr Schichau has come to be of this opinion.

The first large installation of water tube boilers in our navy was on the Monterey. Indeed, at the time, this was the largest installation of water tube boilers in any navy. In this monitor, as you all know, there are four round Ward water tube boilers, with two cylindrical single-ended fire tubular boilers. The water tube boilers have been satisfactory. It is worthy of note that there has been very little difficulty experienced in maintaining a steady water level, although the boilers have a very small amount of contained water. Tubes have failed by pitting several times, though never with any danger to the firemen. The water tube boilers have been twice retubed by the ship's force without laying the ship up at any navy yard. On one occasion, probably with a view to thoroughly testing the water tube boilers, or to satisfy the unholy desires of some person decrying water tube boilers, the ship made a voyage of about 8,000 knots, largely under forced draft, and, whenever possible, with all boilers in use. There was no resultant injury to the water tube boilers, which performed well throughout the trial. The combustion chambers of the cylindrical boilers came out of the trial badly bulged. The Yarrow boilers of the Nashville have operated fairly successfully, though they cannot be said to be completely satisfactory on account of the amount of trouble given by bulging of drums and by leaky tubes. The first set of copper tubes has been replaced by others of steel to considerable advantage. I believe that the latest designs of this type of boiler provide for the use of slightly curved tubes next the fire. This ought to be advantageous. The Marietta's trip around South America, at the beginning of the war with Spain, was quite as successful as was that of the Oregon. The first ship is fitted with Babcock & Wilcox boilers, the second with cylindrical

boilers. No repairs were required to either set of boilers after the completion of the trip. The Annapolis is also equipped with Babcock & Wilcox boilers, and here, as on the Marietta, these boilers have been thoroughly successful. Indeed, a former chief engineer of the Annapolis has stated to me that the boilers of that ship were easier to manage in use and easier to maintain in a state of high efficiency than are cylindrical boilers. The Chicago has several Babcock & Wilcox boilers, and these have so far worked in a thoroughly satisfactory manner, no failure being reported under any circumstances.

The foregoing represents the tried installations of water tube boilers in ships larger than torpedo boats and destroyers in the United States navy. Babcock & Wilcox boilers of the shore or stationary type were installed in the old monitors Canonicus, Mahopac and Manhattan, the old rectangular boilers being entirely worn out and it being deemed advisable to fit these old boats for whatever service they could do. The change was commenced at the beginning of the Spanish war. Before its close the change was complete and a somewhat greater speed was attained than with the original boilers. This change was made without injuring the decks of the monitors. The old boilers were cut up and passed out through the smokestack, down which the parts of the new boilers were passed, the latter being assembled in the engine-room space. This is an instance where none but water tube boilers could have been used, and where every facility of repair and installation was of enormous advantage. For naval vessels with their protective decks the facility with which water tube boilers can be removed or completely renewed without disturbing the decks may, of itself, justify us in adopting water tube boilers. There are building and repairing several other ships of our navy to be fitted with partial or complete outfits of water tube boilers. These include the Alert, Atlanta, Cincinnati, Wyoming (Babcock & Wilcox), Maine and Connecticut (Niclausse), Missouri, Wisconsin and Arkansas (Thornycroft), and Florida (modified Normand).

The foregoing gives the installation of water tube boilers in our navy from which data has been obtained. So far as tried the boilers have invariably been easy of operation, though I have found more skill required to obtain the best results from these boilers than would have been necessary if cylindrical boilers had been used. Particular attention has been given, in all cases, to the feed arrangements. Water tube boilers must have ample feed pumps, and the regulation of the feed must be easy. At first the heating surface of water tube boilers was made 3 square feet per horse power against 2 square feet necessary with cylindrical boilers. This figure has been gradually reduced until now we are down to 2.4 square feet of heating surface per horse power, about as low as I think it is yet safe to go with water tube boilers. The economical results from water tube boilers were at first not particularly good. At present we get quite as good results from water tube boilers of the latest design as from the best cylindrical boilers. The ratio of heating surface to grate surface has been kept up to at least 40, although we do not yet feel warranted in allowing as small grate surfaces in water tube boilers as in cylindrical boilers. Water tube boilers lose in efficiency when forced, especially those of the straight tube type. Of course, this is not of very great moment to us in a naval vessel which is under forced draft only at maximum speed, but it is nevertheless a disadvantage. The following table shows the relative economy of cylindrical and water tube boilers:

RELATIVE ECONOMY OF CYLINDRICAL AND WATER TUBE BOILERS.

	Annapolis.	Marietta.	Newport.	Princeton.	Vicksburg.	Wheeling.
Type and number of boilers	(2 B. & W.)		(2 single-ended cylindrical.)			
Displacement, tons	1,000	1,000	1,000	1,000	1,000	1,000
Knots per ton of coal at most economical speed	26.38	22.27	18	19.6	21.25	16.6
Number of screws	1	2	1	1	1	2
Grate surface, square feet	98	94	78	78	78	60
Heating surface, square feet	3,620	3,661	2,524	2,524	2,524	2,508

The increased grate surface we have required with water tube boilers will be a positive advantage to our ships' steaming qualities. I consider that sustained sea speed depends largely upon the grate surface. Heating surface, of course, must be provided, but I should prefer an excess of grate surface to an exceedingly high ratio of heating surface to grate.

Up to this time we have had no trouble from salt water or grease in water tube boilers. Indeed, we could hardly be more troubled by salt water with this type of boiler than we have been with cylindrical boilers. We suffered severely in our short war with Spain from dropped furnaces in cylindrical boilers. I do not think that a properly designed water tube boiler will give more trouble from the use of impure feed water, such as sometimes we have at sea, than any other boiler. I do not think tubes more liable than furnaces to fail from a deposit of scale. In any event, the evaporating plants of all our ships are being made adequate to give fresh feed water. The only danger of salt water in the future should come from leaky condensers.

Glancing abroad, for a moment, we find every modern naval power, from England to Japan, committed to the use of water tube boilers on the largest scale. Each of these countries has had its experience, and each has decided not only that water tube boilers can be worked, but also that they work well and that they must be used in naval vessels. I will give a few observations on the working of various types of water tube boilers abroad. The result of a first glance would seem to be that anything would do to make steam, from Watt's tea-kettle to the most complicated of modern steam generators. I know of one French boiler (you know what ingenious mechanics the French are) composed equally of water and fire tubes. The tubes were concentric and the distance between them but one millimeter. Of course the amount of water is very small—so small as to put this boiler in the class called by their originators "inexplosible." This boiler was tried at the works of the maker with good results. It was next tried in a torpedo boat with equally remarkable results—seven men killed, I believe. We have read of explosions, however, of really well-designed water tube boilers. Generally it is found that a tube had failed and that the furnace door was open—the result, more or less fatal burns to all in the fire-room. We hear of all the failures but the successes are never mentioned. It is not difficult to foresee the failure of a boiler plant designed to furnish 120,000 pounds of steam per hour but regularly required to furnish 160,000 pounds per hour. If nothing else fails the feed pumps will not do the work and the tubes will, of course, be burnt out. This would happen with any type of boiler. You see, I harp on the failures, for I find I can glean the most information from them. Many of the failures have come from the use of boilers that were inaccessible for cleaning and repairs; others from faulty design; others from poor workmanship; others, again, from neglect. Water tube boiles require skilled attendance. Other boilers have failed from poor material; others from failure of the feed pumps; but there is not one, so far as I know, that can properly be said to have failed purely as a result of being a water tube boiler. Failures may come from misusing water tube boilers but not from using them. I consider that the experience of the last ten years or more in our own and foreign navies justifies me in stating that water tube boilers, when proper precautions are used, can be successfully adopted for the steam generating plant of ocean-going vessels. They are necessities to the best design of warships.

CLAIMS FOR AND AGAINST WATER TUBE BOILERS.

I would naturally come now to a discussion of the claims of the adherents and opponents of water tube boilers. You have all heard these arguments and it seems almost useless to go over them. I shall simply state what I believe to be the advantages and disadvantages of water tube boilers compared with cylindrical boilers: Advantages—Less weight of water; quicker steamers; quicker response to change in amount of steam required; greater freedom of expansion; higher cruising speed; more perfect circulation; adaptability to high pressures; smaller steam pipes and fittings; greater ease of repair; greater ease of installation; greater elasticity of design; less danger from explosion. Disadvantages—Greater danger from failure of tubes; better feed arrangements necessary; greater skill required in management; units too small; greater grate surface and heating surface required; less reserve in form of water in boiler; large number of parts; tubes difficult of access; large number of joints; more danger of priming.

A saving in space has been claimed for water tube boilers, but I do not find this claim sound when account is taken of the increase in grate and heating surface necessary in water tube boilers to ensure satisfactory working, and because of small units the space for accessibility is increased rather than diminished. The fact that water tube boilers raise steam quickly is of the greatest advantage. I have stated elsewhere that I consider the battle of Santiago to have developed the necessity of the use of water tube boilers whether it taught us anything else or not. It would have been of the greatest advantage to have had, during the blockade of Santiago, boilers capable of raising steam in less than half an hour. Coal need not have been used to keep all the boilers under steam all the time. The Massachusetts might have shared in the glories of the fight if she had been fitted with water tubes boilers. The Indiana would have kept up with the Oregon and the Texas. The New York would have developed at least three knots more speed and the navy would have been spared a controversy. I think the Colon would not have gotten as far away as she did. But we did not have the water tube boilers.

The higher pressures possible with water tube boilers give us smaller and safer steam pipes and better valves. It decreases the size of the fittings and the difficulty of tracing the labyrinth of a ship's piping. It increases the efficiency of the engines. The introduction of compound engines forced us to use cylindrical boilers. In the same way the use of quadruple expansion engines necessitates, for economy, the use of water tube boilers. But the quick steam raiser is, because of that very fact, not so safe as its predecessor. Of course, nothing on a man-of-war is very safe in war time, but we want things as safe as possible, and the boilers are the keys to the situation in the modern battleship. I think that safety in handling water tube boilers may be assured by using skill in the fire-rooms. I have more than ten years' successful experience with water tube boilers on which to found this opinion, and I submit that the boilers, placed as they are behind the heaviest armor and below the thick protective deck, are, at the worst, the safest apparatus on a battleship. If we can make them work well we would do wrong to refuse to use water tube boilers on our ships.

For merchant and for yacht practice it is a different question. I was recently asked what boilers to use in a large steam yacht. I recommended cylindrical boilers. For merchant work the boilers are always in use developing a fixed power. Weight is not there so important as in warships, and I think it is at best a moot question whether cylindrical boilers are not still the best that can be fitted in ocean-going merchantmen. In some cases where there are short trips and the opportunities for repair must be gotten during the very short lay-ups at the end of the route, the quick steam raising qualities of water tube boilers, with their freedom of expansion, enables blowing down the boiler immediately on arrival in port and still having steam at an hour's notice on all boilers. Such cases as this seem to me to demand water tube boilers.

As to the type of boiler to be used there are as many to choose from as there are fleas on a dog. Someone has said that a certain amount of fleas keep a dog from brooding over being a dog. So the number of varieties we have to choose from may be a good thing for all.

I have always opposed the use of boilers containing screw joints in contact with the fire, and have attempted to secure boilers having no cast metal in the pressure parts. Cast steel is not yet good enough to put between 300 pounds of steam and our firemen. I believe in straight tube boilers as being easier of examination and repair than bent tube boilers. I believe in large tube boilers for the same reason and because the tubes are thicker and have more margin for corrosion. I believe in boilers having as few joints as possible. Water tube boilers must have freedom of expansion of the various parts, and the simpler the boiler the better. It should not be necessary to introduce reducing valves between the boilers and the engines to secure a steady steam pressure at the latter, nor should it be necessary to have automatic feed arrangements to ensure steady water level in the boilers. To be successful a boiler must be easy of repair. Lightness is a natural attribute of all water tube boilers, but it is not wise to go too far in this direction. The ratio of grate surface to fire

surface occupied for the complete boiler plant must be as large as possible. The units should be large, the grates short and not too wide. The passage of gases through the tubes should be sufficiently long to ensure economy. These gases should be well mixed before entering the spaces between the tubes for the same reason and to prevent smoke. The circulation of the water in the boiler must be free. Tubes should not be too long and the fire rooms must always be sufficiently wide to provide for free withdrawal.

The foregoing is what we want. We have most of the above desiderata in several well-known types of boilers, and ultimately we shall discover the value of each of the foregoing points, and then it will be possible to differentiate between the various types more perfectly than we now can. In the meantime, all that I have to say is that the use of water tube boilers has been definitely decided upon for our naval vessels, because water tube boilers give tactical advantages of great moment, and because, with care in the selection, manufacture, and management of water tube boilers, other disadvantages may be neutralized.

SHIPS OF THE GREAT LAKES.

MR W. I. BABCOCK, GENERAL MANAGER OF THE CHICAGO SHIP BUILDING CO., DESCRIBES FOR THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS, THE SYSTEM USED IN THE CONSTRUCTION OF THE HULLS OF LARGE BULK FREIGHT CARRIERS.

While the systems used in the construction of the hulls of modern steel vessels are somewhat the same in all lake yards, it is the purpose of the following article to describe the practice of the Chicago Ship Building Co. only, and that as applied to the ordinary lake bulk freight vessel of large size. For a proper understanding of what follows, it is necessary first to describe the ship itself, inasmuch as the requirements of the service have developed a somewhat peculiar type of vessel. The great majority of modern steel lake vessels are designed to carry only iron ore, coal or grain in bulk, and no deck, therefore, is required or laid on the main-deck beams in the cargo holds. The movement of ore and grain is entirely from upper to lower lake ports, and of coal in the opposite direction. As, however, there are a great many wooden vessels still in service which require up-cargoes, and coal cannot be unloaded rapidly, the freight rate on coal is seldom attractive, and the big steamers, especially those belonging to the great ore and steel companies, go back light, using water ballast alone when any is required.

The season of navigation being limited by ice to about seven months in the year, despatch in port is of the utmost necessity, and as the cargoes are all spouted in, the ore and coal from elevated docks and the grain from elevators, and taken out by machinery on the docks, hatches are many in number, and no hoisting machinery is carried on the ships themselves. The connecting channels between the lakes being comparatively shallow, the vessels are built with a plate keel, very flat floor and full model to get as great capacity as possible on the limited draught available, and a large number of frames amidships are exactly alike, as many as one-half to two-thirds the total number. When coming light to a loading dock, they therefore float very high out of the water, and to obtain the necessary slope to the spouts the hatches are made as wide as possible athwartships, leaving only stringer enough for strength on each side. While it is true that the upper deck could be depressed by filling the water bottom, this would cause a loss of time in loading, as it is evident that the cargo can be run in much faster than the water could be pumped out, and is, therefore, not allowable. The longest straight run in open water is across Lake Superior, some 400 miles, the total voyage being under 1,000 miles. Coal for fuel being available at various points in the connecting rivers, no great bunker capacity is required, and, the fuel hatches opening in all cases through the upper deck, a few minutes suffices to spout in the amount desired from elevated pockets. At lower lake ports it is usual while the cargo is discharging to fuel from a lighter alongside provided with a hoisting derrick reaching into the fuel hatch.

The danger of grounding in the narrow, tortuous, and in many places rocky channels connecting the lakes themselves being considerable, double bottoms are a necessity and are carried straight across on top to protect the bilge to the upper turn. To get sufficient water ballast, as well as to raise up an ore cargo and make the ship easier in a seaway, the tank is made deep, from 5 to 6 feet at the center line. Carrying the cargo at this height above the floors requires heavily stiffened and closely spaced girders or longitudinals, which are intercostalled between floors to further support them and the bottom plating against grounding strains. The use of channel floors for the flat bottom is now universal, and results in a considerable saving in first cost, as well as avoiding the continual shearing of frame rivets and cracking of frames through the rivet holes from grounding when the bottom construction is the ordinary plate floor with frame and reverse bar. Ore and coal loading docks having the spouts uniformly 12 feet centers, all hatches are spaced 24 feet centers fore and aft, and the frame spacing is always 24 inches, no matter how large the ship, the frames being channels. Hatches are 8 feet fore and aft and channel web frames or belts are spaced every 8 feet, making one belt at each hatch beam and one in the center between hatches, on which a main-deck beam is also placed. To avoid interruption of the loading spouts by machinery spaces, as well as to avoid the inconvenience of a shaft alley in the cargo hold, the machinery is placed aft, the engine going as near the stern-post as the shape of the ship will permit, and the boilers and bunkers being next forward, either in the hold or on a raised deck, with cargo space beneath.

From all of the above considerations a type of vessel has been developed, of which the steamer Mauna Loa* of the Minnesota Steamship Co., just completed in the Chicago yard, may be considered a fair example. The ship is 430 feet keel, 450 feet over all, 50 feet moulded beam, and 28½ feet moulded depth, with a 5½-foot water bottom. She is propelled by a quadruple-expansion, four-crank, jet condensing engine of some 2,500 H. P., taking steam at 250 pounds pressure from two Babcock & Wilcox marine water tube boilers. The light-load displacement is about 3,200 net tons, and on 18 feet 3 inches draught she carried 6,816 gross tons of iron ore. The water ballast capacity is 2,900 net tons. Speed loaded, 12 statute miles per hour, and light, 14 miles. The system used in the Chicago yard in constructing this ship and similar vessels is as follows:

The general dimensions, midship section, and positions of hatches and bulkheads having been agreed upon, a model is prepared, and from it the length of the straight midship portion of the ship determined. At the same time, a butt plan of the keel, bottom plating, center keelson, rider, longitudinals, tank margin, and all fore and aft angles is prepared, and on the mould-loft floor a reproduction of the midship section drawing is made full size. From this the widths of the various bottom and bilge plates are measured exactly, the necessary allowances made on the outside plates for bevel shearing and the mill orders prepared at once. Wooden templets for the brackets at center keelson, bilges, tank top, and deck beams are made with the necessary allowance for flanged edges and sent direct to the plate mill, so that all these brackets come into the yard sheared to exact size. The lengths of the channels for floors and tank-top seam straps, and of the angles for the keelson and longitudinal stiffeners, bilge frames, etc., are taken directly from the floor and orders sent to mill. It will be understood, of course, that as there are a large number of dead flat frames—114 in this ship—this enables a large quantity of material, both plate and shapes, to be ordered in duplicate pieces from the floor very quickly from the midship section only, and without waiting for the body plans to be completed. After the lines are faired and the body plans completed on the floor, the remainder of the ship is ordered in the usual manner. The laying down in the loft being completed, the next step is the making of the wooden moulds. For the straight part of the vessel amidships, below the tank top, it is evident that one mould only is required for the channel floors, with strip (narrow) moulds for top and bottom flanges, one for the ordinary bilge brackets, and one for the belt bilge brackets, from which all are punched. Also that one mould each suffices for the center vertical keelson and rider for all plates from the forward collision to the engine bulkheads, the keelson being of uniform depth, and one keel mould answers for all the keel plates until the floor line at either end leaves the dead-rise line within the half breadth of the keel plate. For this keel mould, as well as for all moulds for butted plates, strips of lignum-vitæ, adjustable for screws, are fitted into the ends, so that any variation in length from swelling or shrinking of the pine from which the mould is made can be taken up and the exact length secured. When lapped butts are used this refinement is not required. One mould also answers for nearly all of the center vertical keelson brackets; two moulds for C. V. K. angles, one for each flange; one for the stiffeners of each longitudinal for all the flat of bottom; two for keel bars; two for top C. V. K. angles; two for channel seam straps under tank top; two each for top and bottom longitudinal angles; one for the high plate floors dividing the separate compartments of the water bottom. For the skin plating on the flat of bottom one mould suffices for all the plates in each strake. Similarly, one mould answers for all the tank-top plates except where the water-tight floors would come at a seam, which is undesirable for water-tightness, and, therefore, avoided by putting in a narrow plate, and one mould for all the tank-top margin plates amidships.

In laying out all fore-and-aft members, both plates and angles, from these moulds certain allowances must be made, as follows: Where the turning space comes—that is, where the siding flange of frames and floors changes from looking aft to looking forward—the distance between frame rivets, instead of being exactly 24 inches, is less by twice the distance from heel of floor to center of rivet, and the mould must be moved up that amount. Where the water-tight plate floors come, the moulding side of the frame is moved a distance equal to the thickness of the plate, as is also one center keelson stiffener, the rivet spacing is lessened for water-tightness, and extra holes put in on outside strakes of bottom plating for the wide liners. At the belt floors, the small bracket connecting the longitudinal stiffener to the channel seam strap shifts the stiffener over by the thickness of the bracket and necessitates a liner of corresponding thickness between the stiffener and the floor. And wherever a butt comes in an adjoining member, requiring different spacing of rivets, these must be allowed for. In all such cases, "space moulds" covering only the particular frame space in which the change is necessary, are applied after the remainder of the member has been laid out from the regular mould. It is evident, therefore, that a very large amount of material, both plate and shapes, sufficient to build almost the entire water bottom of the ship for the straight midship body, and a considerable part of the material for some distance forward and aft of same, can be gotten out rapidly, from a very small number of moulds, ready to go into place, before the keel is laid.

The practice of the Chicago yard, as of all other lake yards, is to build the ship on level stocks and launch sideways. The keel blocks are now set, one to each keel plate, by a surveyor's level, and the center line put in by a transit instrument, the keel plates are strung along them, the butt straps and liners bolted up and four tack rivets driven by hand in each strap to avoid possibility of shifting. Then one keel bar is put up, the center vertical keelson plates and butt straps, the other keel bar, keelson top angles and stiffeners and all carefully bolted and reamed. A large amount of work is thus ready for the pneumatic yoke riveters, which are then started and the whole keelson riveted and caulked water-tight. In the meantime the various parts composing the floors have been punched, assembled on a long line of skids extending from the stationary steam riveter, tested by the mould, bolted carefully and reamed by pneumatic drill and riveted. It will be noticed that of all these pieces—namely, the channel floor, center keelson bracket, bilge bracket, bilge frame, longitudinal stiffeners and clips—only one piece, the bilge frame angle, has any curve to it. This angle is bent cold between two collars temporarily bolted to the upper roll of the ship yard bending rolls, the bilge being made an arc of a circle to facilitate this rolling as well as that of the bilge strakes of the hull plating. For more than half the length of the ship, therefore, there is no furnace or forge work in any part of the water bottom except the few angle collars required to make water-tight work at the tank

*Mr. Babcock's paper is accompanied by some twenty or more plates that illustrate the system pursued in the construction of the Minnesota company's steamer Mauna Loa, and various applications of pneumatic tools are also shown, but these or similar illustrations have been so often printed in the Marine Review, that there is no need of reproducing them.

divisions. This applies also to a considerable part of the water bottom forward and aft of the straight midship body, and, as will be seen hereafter, to a large part of the ship above the tank top. Forward and aft of the midship body the channel floors are continually growing shorter and the bilge brackets longer, as the extremities are approached. The bilge bracket soon becomes too large if its inner edge is kept straight, and it is, therefore, cut out to a curve and fitted with a reverse frame. When the channel diminishes to about 6 feet in length its use is abandoned and ordinary plate floors with frame and reverse frame substituted.

While one diminish mould for each body answers for the floor channels, separate moulds for each bilge bracket must be made. When bolting the various parts together, however, to make the complete floor, the same test moulds answer as are used for amidships, the position of the outboard upper point of each frame being marked upon them, so that all the floors from one end to the other of the water bottom are completed and riveted at one time. The center keelson having been riveted and caulked, heavy floor ribbands are now erected at each side at a distance from the keel just inside the extremities of the floor channels. The garboard plates are now raised into position, bolted to the keel plate on the inner edge and held up by temporary vertical shores near the outer edge. Similarly the other strakes of the bottom plating for all the flat part of the bottom are put up in succession and supported in the same way. The total weight being small, only very light shoring is required. The floors are now brought over by locomotive crane from where they were stored, after being riveted on the hull machine, and dropped into place on top of the bottom plating by an overhead traveling crane. The inner end rests on the keel and the outer end on the floor ribband, a bolt or two through the bracket and keelson stiffeners being put in at the same time. Quickly thereafter the longitudinals and intercostals are put in, the channel seam straps rove across, and the whole carefully leveled and squared up, one or two tank-top plates being put on to hold everything secure. All the work is now carefully bolted, reamed by pneumatic drills, and is ready for riveting, which is started at once amidships by pneumatic yoke riveters for the inside and by pneumatic shell riveters for the bottom plating, nearly all the rivets in the hull being machine driven. As soon as the channel seam straps and ties are riveted to the bilge brackets, the tank margin plates are put on and the angle on top of same for the bracket connections, and all riveted.

The bilge plates are now templeted from the work, punched, rolled, and bolted up in position. That these plates are not gotten out from moulds like the others is principally because the very careful work on a surface of so sharp a curve is too expensive. At the lapped butts it is evident that the radius is greater for the outside plate than for the inside, and in any rolled plate the necessary difference between the lengths of the two surfaces is obtained sometimes by compression on the inside and sometimes by extension on the outside, and there is no way of determining beforehand which will occur. Further than this comes in the slight irregularity in the height of the floor ribbands, the effect of which is magnified at the bilges, increasing the chance of bad holes and spoiled plate. While the use of this mould system requires in any event a good solid foundation under the ship, it must be remembered that this is only piling; that shores and blocking are of wood, only roughly cut to length and wedged up; and that ribbands are also of wood, supported only at intervals, and lined up principally by a ship's carpenter's eye. While our experience has amply proven that for such parts of the bottom as have been already described—all straight work—these sources of error are quite negligible, that is not so with the bilge plates, even amidships, and it is much cheaper to templet these plates than to spend the time and money necessary to bring the framework of the tank to such perfection of outline and spacing that mould work could be depended upon in all cases.

With the bilge plates in place, the water bottom for the straight midship body of the ship is completed. The remainder of the shell plating within the limits of the water bottom, the margin plates and other plates of the tank top are templeted off in the ordinary manner. In the meantime, the channel frames and belts for the sides of the ship above the tank for the straight midship body and for some distance forward and aft of same, until the curvature becomes too great and bevelling commences, have been cambered cold in a heavy power bending press. These frames and belts having been ordered to lengths taken directly from the mould-loft floor, the variation in length is very slight from what is actually required, and is taken up at the lower ends, which stop about 4 inches short of the margin plate of tank to form a waterway. The main-deck line and side stringers, and the plate edges of all side strakes, are run in parallel to the upper deck sheer. One mould for the web and one for each flange of frames and bolts, therefore, answer for all holes down to and including the lower side stringer. The holes at the bottom for the rivets connecting the channel frame or belt to the tank-top bracket are put on from the same mould, but as these holes are set to a level line, which is the height of the top of the center vertical keelson, the mould must be moved down at each frame a distance equal to the raise of the sheer at that frame, these sheer heights of spar deck being marked on the upper end of the mould. The spar-deck beam brackets and the main-deck lower brackets are now laid out, each from its own mould, for all that part of the ship for which the tumble-home is constant, punched, bolted on to the frames and belts, and riveted by a stationary riveter. The spar-deck beams are cambered and, with the straight main-deck beams, stanchions, shifting boards, channel ties and struts and 'thwartship hatch coamings, laid out from moulds and punched. Side stringer channels, which are in short lengths between belts, and Z-bar clips between frames are laid out, punched, and riveted together on the ground by portable yoke riveters. Main-deck stringers for the straight body are laid out and punched, with the channel intercostal to the skin between belts, which is scored out to allow the frames to pass through.

The three upper strakes of the side plating for the straight side are now laid out, punched, and countersunk. For the lowest of the three, the main-deck sheer, this does not include any more plates than those on the midship body, as the frame line begins to leave the tumble-home line at its lower end immediately the extremities of the dead flat are passed, the point of departure going higher with each frame. The between-deck strake has a larger number of plates on the flat side and the sheer strake the most of all. For laying out these shell plates a slip mould is used. I believe that this method of laying out side plating is original with Mr. E. Gunnell, superintendent of the Chicago Ship Building Co., to whom, in fact, the most of the development of the system is due. This mould is based on the principle of working from a level line parallel to the keel of the ship. The mould itself is square, the length inside of the end pieces being the exact length of the plate. At about its center a straight line is marked across it. The frame strips and butt lap moulds are entirely separate from the main mould and have similar lines marked upon them, one butt mould having in addition a scale of inches marked on it, starting from the line at zero. The fitter is furnished with a table, prepared for the mould-loft floor, showing the sheer height of the spar-deck line at each butt. The squaring mould is now placed on the plate, the line on one butt mould brought into exact accordance with the line on one end of it, and the other butt mould raised until its line is a distance above the level line on the squaring mould equal to the raise in the sheer from the table. A chalk line is then stretched between the two ends, snapped on, and the mark on each frame strip brought exactly to it. All the frame and butt holes are now transferred to the plate and the moulds are removed. When the seam lap moulds have been put on and the holes marked the plate is ready for punching and countersinking. If the sheer of the ship is so bold that the variation from the straight line in the length of a plate must be taken into account, it is only necessary to use the exact sheer height at each frame in setting the frame strips, but this seldom happens.

There is now a large portion of the hull of the ship above the tank ready for erection, and it is assumed that sufficient of the water bottom, if not all of it, is completed and riveted, for a start to be made on the upper work. The water bottom or tank now forms a broad, solid foundation on which the remainder of the framing is erected, requiring no side shores whatever until the very extremities of the ship are reached. Evidently, however, as so much of the upper works have been laid out from moulds, any inequalities, however slight, in the tank must be corrected before this erection is started, otherwise bad work will result and the various pieces will not come together correctly. For this purpose a line is leveled across the top of the center vertical keelson and marked on the inside of the bilge plates above the tank, corresponding to the line from which the side frames and belts were punched, referred to previously. The frame and belt brackets are now placed in position between the angles on the tank-top margin plates and the position of this level line transferred directly to them, and at the same time the bottom holes are marked from the angles. The bracket plates are then taken to the shop and the remaining holes for the frame and belt rivets marked off from the moulds which were used for the corresponding holes in the frames and belts. As these moulds in each case are set from the level line spots referred to, it is evident that when the brackets are put back in position on the ship and the frames and belts bolted thereto, their tops will come true to the spar-deck line independent of high or low points in the tank margin itself, and, therefore, the main-deck line, stringers, and plate edges will also come true.

The belts, stanchions, and main-deck beams are now erected by the overhead crane, leveled, plumbed, and squared up, the whole making a self-containing structure. The sheer strake is then bolted into place and the frames put up. As soon as the shifting boards, bulkheads, and main-deck stringers and ties are in place, the spar-deck heads are put in and the shell plating bolted up with the upper and lower side stringers. The spar-deck plating between hatches which had previously been punched from moulds—corresponding plates in each space being exactly alike, except for manholes, mast holes, etc.— is now put in place, as well as the channel ties and intercostals under and between the spar-deck beams, and the athwartship hatch coamings. When all bolted and reamed a large amount of work, both inside and shell, is opening up for the machine riveters. The remaining strake of side plating amidships—that immediately above the bilge—is now templeted off the ship, thus eliminating the effect of any variations in the height of the tank margin.

The above description includes about all of the ship which is gotten out by what may be called duplicate mould work. The remainder of the framing at the ends, etc., is laid out, furnaced and punched from ordinary individual wooden moulds, and the plates, stringers, etc., templeted off the work in the usual manner. No scrieve board is used. In general, it may be said that the system used in the Chicago yard requires very careful work in the mould loft, explicit directions to the foreman in charge of each ship, and a thoroughly competent and experienced superintendent in actual charge of the yard to harmonize the work of the various shop and outside foremen and to decide where duplicate work shall stop and a return be made to ordinary methods. This is principally a matter of cost in every case. If too much time and labor is required to bring certain portions of the structure to such exact accordance with the mould-loft floor, that other portions following them, laid out from moulds made from the floor, will go exactly into place, it is cheaper to follow ordinary methods, where a much greater variation is allowable, because each piece is based only on the piece next ahead of it, and therefore, errors are not cumulative. As a matter of personal opinion, however, after an experience covering the construction of some thirty ships of large size under the mould system, the writer thoroughly believes that this system is the cheapest known and can be applied to a large extent with great advantage in any yard where large ships are built, of any type.

WELL REPRESENTED AT GLASGOW.

A Glasgow correspondent of the Marine Review says: "The relative interests of the nations in shipbuilding is well shown by the number of students they give to the subject. At the University of Glasgow, the international school for the study of naval architecture, the nationality and number of students is as follows: American, 15; Scotch and English, 13; Belgian, 2; Argentine, 2; Japanese, 2; Swede, 1; Finn, 1; Italian, 1.

"As to the type of water tube boiler to be used, there are as many to choose from as there are fleas on a dag," says Engineer-in-Chief Melville of the United States navy. "Someone has said that a certain amount of fleas keep a dog from brooding over being a dog. So the number of varieties we have to choose from may be a good thing for all.

BUREAU OF NAVIGATION REPORT.

MERCHANT COASTING FLEET THE LARGEST IN OUR HISTORY, BUT ONLY 9 PER CENT OF OUR EXPORTS AND IMPORTS WERE CARRIED IN AMERICAN VESSELS LAST YEAR—STRONG ARGUMENTS IN FAVOR OF A MERCHANT MARINE FOR FOREIGN TRADE.

Washington, D. C., Nov. 22.—The annual report of Mr. E. T. Chamberlain, commissioner of navigation, shows that American shipping industries shared in the general prosperity of the country during the past fiscal year. The returns disclose more satisfactory conditions than those of any former year in the history of the bureau of navigation. The total documented tonnage on June 30, 1899, comprised 22,728 vessels of 4,864,238 gross tons, which is our largest since 1865. The tonnage operating under our coasting laws, 21,397 vessels of 4,015,992 gross tons, is the largest in our history, and greater than the coasting tonnage of any other nation. Our steam tonnage, 2,476,011 tons, for the first time exceeds the tonnage of all other craft. In the rest of the world steam tonnage eleven years ago exceeded sail tonnage. Our tonnage registered for foreign trade remains small, and last year American vessels carried a fraction less than 9 per cent of our exports and imports, the smallest percentage in our history. Based on Bureau Veritas returns, the world's sea-going sail tonnage in the past quarter of a century has decreased from 14,185,836 tons to 8,693,769 tons, a decrease of 40 per cent. The decrease in the United States has been at the average rate. The world's sea-going steam tonnage in the same period has increased from 4,328,193 tons to 18,887,132 tons, or 336 per cent. The phenomenal increases have been Norway's, over 1400 per cent, and Germany's, nearly 700 per cent. The increase of the United States has been only 68 per cent, and the increase of American steam tonnage registered for foreign trade on the Atlantic and Gulf coasts has been only 38 per cent. The development of Alaska within the past few years has caused a rapid increase in Pacific coast tonnage. Within the past twenty years the United States in sea-going steam tonnage has dropped from the second place next to Great Britain to the fourth position, below Germany and France, and if steamships in foreign trade alone are considered, below Norway and Spain, and only slightly ahead of Japan. The report reviews briefly the legislation of other nations in behalf of their merchant shipping, showing that last year European nations and Japan expended over $26,000,000 to promote it in various forms, while the United States spent only $998,211. On their steamship lines to China and Japan foreign nations expended about $5,000,000, while for the same purpose the United States expended less than $49,000. The establishment of two or more fast American steamship lines on the Pacific coast to connect with Asia will furnish the capitals of western Europe with closer mail and passenger connections by from three to five days than is now possible by the heavily subsidized British, German and French steamship lines through the Suez canal.

The reasons which impel other nations to develop their merchant shipping, says Mr. Chamberlain, apply with equal force to the United States. Among them are first, the relations of the navy to the merchant marine as an element of national defense; second, relations of a merchant marine to insular territory; third, its relations to new markets in Asia, Africa, Australia and South America; fourth the necessity for the best ocean mail facilities under the flag; fifth, the relation of the merchant marine to exports and imports and the value of the carrying trade, and finally, the promotion of ship building and contributory industries. By various methods of computation the annual value of the ocean carrying trade of the United States is estimated at about $175,000,000, including passenger and immigrant fares and payments for ocean mails to and from the United States. The argument that American shipping in the foreign trade is handicapped by tariff duties is met by reference to progressive legislation beginning in 1872, by which for the last five years all materials for the construction of American vessels in the foreign trade and all supplies for such vessels have been exempt from duties. Tonnage taxes, which are imposed equally on foreign and American vessels, are the only form of federal taxation on American shipping. The proposition to repeal tonnage taxes would, therefore, in effect be equivalent to a bounty of about $750,000 annually to foreign shipping and would relieve American shipping of only $80,000 of taxes annually.

The report then takes up the five methods which have recently been suggested for the promotion of the American merchant marine. It is pointed out that discriminating duties on cargoes in foreign vessels or on the tonnage of foreign vessels are an impracticable remedy on account of the provisions in our treaties with nearly all the nations of the world, prescribing equal treatment for foreign and American vessels in the matter of duties and charges. The same objection also applies to the proposition to grant bounties on exports in American vessels, as by the terms of our principal treaties we are obliged to grant the same bounties on exports in foreign vessels as in American vessels. The proposition to grant American registry to foreign-built vessels in the foreign trade is not regarded as feasible in view of the unanimous rejection of that proposition four years ago by the senate committee on commerce, and on account of the fact that American ship owners and ship builders are united in opposition to that measure. It is also pointed out that regardless of the merits or demerits of the proposition, its adoption would probably disappoint its advocates, in view of the fact that the cost of operating vessels under the American flag is concededly much greater than the cost of operating foreign vessels. The adoption of the free ship policy by Great Britain has not contributed in any way to her maritime development, as vessels for many years have been built more cheaply in Great Britain than elsewhere, and in point of fact, vessels built outside of Great Britain are seldom registered under the British flag, with occasional exceptions in the colonies. The success of the free ship policy in Norway and other Scandinavian countries is due to their very large maritime population, which renders it necessary for the governments of those countries to encourage the purchase of vessels built in Great Britain, in order to afford employment for their seamen. Even then the tonnage under the Norwegian flag is insufficient to furnish employment for Norwegian sailors, who constitute a large part of the crews of British vessels and of American vessels, both in the coasting and in the foreign trade. The rates of wages paid to Norwegian sailors are much lower even than those paid on British or German vessels, and the general cost of operating vessels under the Norwegian flag is less than under the British flag. These conditions, none of which obtain in the United States, have rendered the adoption of the free ship policy by Norway a national necessity. The conditions in Germany, in so far as the cost of operating vessels is concerned, are analogous to those of Norway, and up to 1885 there were very few ocean steamships under the German flag built in Germany. The development of German ship yards since 1885 is attributable in part at least to legislation advocated first by Prince Bismarck, through which a heavy subsidy was granted to the North German Lloyd Steamship Co., which owns all but four of the fast steamships under the German flag, and to the German law by which materials for steamships are carried on the government railroads at low rates of freight. The proposition to develop the merchant marine through ocean mail subsidies is only a partial solution of the question. While the need of at least two fast mail steamship lines to Asia and one to South America is indisputable, the establishment of such lines would not suffice to put our navigation and ship building on a satisfactory basis.

The report in the main is devoted to a consideration of senate bill 5590, reported by Senator Frye at the last session, as a substitute for the bills introduced by Senator Hanna and Representative Payne. It is pointed out that the maximum expenditure under that bill for any one year is fixed at $9,000,000, from which, however, should be deducted $1,500,000, the present cost of carrying our ocean mails on American vessels, which will continue whatever the fate of the bill may be. The actual maximum annual expenditure proposed by the bill is thus in effect fixed at $7,500,000. Assuming that all our vessels registered for foreign trade were fully occupied throughout the year at the present time, the net expenditure under the bill would be in round numbers $3,000,000. Before the maximum is reached the capacity of our ship yards must be increased many times, and the tonnage under our flag engaged in the foreign trade multiplied several fold. This increase in the capacity of our ship yards and in our tonnage in foreign trade will show ability on our part to compete on more nearly even terms with foreign nations. The prorata reductions in compensation provided for when the maximum expenditure of $9,000,000 is reached will thus coincide with the lessened need of government assistance. During the decade ending 1898 our ship yards produced only 213,000 gross tons of ocean steamships, while in the same period German yards turned out 350,000 gross tons, and British yards 9,680,000 gross tons.

The difference in the cost of construction and operation of American and British vessels is considered in some detail. It is also pointed out that of the 362 steamships of 14 knots or over now in existence in the world, over 80 per cent are receiving in one form or another assistance from the government to which they belong, aggregating upwards of $20,000,000. This is deemed justification for the proposition in the bill to give a distinct allowance to American steamships of 14 knots or upwards. Comparison is made at length between these special rates under the bill with the eight principal British ocean mail contracts, and it is shown that while the British mail contracts involve the annual payment of $3,900,000, the payments under this bill designed as an offset to the British payments for similar services with similar vessels under the American flag would be $3,580,000. The bill would be inadequate if it were proposed to parallel British lines, especially those to Asia and Australia. The American lines which will be established under the bill, however, to those quarters of the globe will not be compelled to pay Suez canal tolls, and the compensation proposed will thus be adequate. Comparison is also made in detail with the new North German Lloyd subsidy of $1,320,000, and it is shown that corresponding American steamships under this bill would receive $1,295,000, though the cost of building and operating the German steamships is much lower than the corresponding cost of American vessels.

Full official tables of the wages on American and British vessels are printed, and to elucidate the conditions the monthly pay-roll of five steamships, each of about 2500 gross tons, is printed in full; the American Cherokee's roll being $1,385, the British Critic $852, the German Sonnenburg $646, the Dutch Teutonia $554 and the Norwegian Fortuna $511.

The report also recommends moderate increase in our tonnage taxes, equalizing them with those imposed at the principal European ports, and favors the passage of bills applying the laws of the United States relative to commerce, navigation and merchant seamen to Hawaii and Porto Rico, thus bringing those islands under the coasting laws of the United States. It is recommended that vessels owned by Cubans be placed by law on an equality with vessels belonging to the most favored nation. Under an existing statute it has been necessary to impose a tonnage tax of $1 per gross ton—practically prohibitory—upon such vessels, and this injustice both to ourselves and the Cubans can be remedied only by legislation. Under the so-called White bill for the protection of seamen, American sailors now enjoy a larger degree of personal liberty than ever before and much more than the seamen of any other nation, that law radically changing the nature of the seaman's agreement. Reports from shipping commissioners show that the allotment sections have been of decided benefit to seamen and that efforts to break down these sections during the spring and early summer have failed and the law is in the main successfully enforced. Attention is directed to the menace to navigation resulting from long tows of coal barges along the Atlantic cast, especially at New York, Boston, and other important harbors, and of the large timber rafts on the Pacific coast.

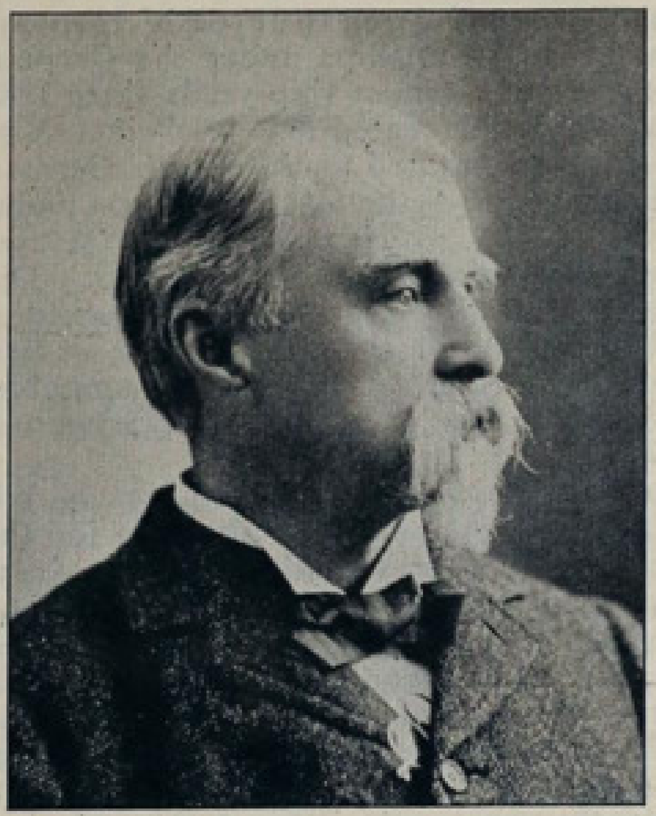
Besides the usual tables the report contains a list of the world's fast steamships and of American steamships registered for foreign trade at the end of the fiscal year, and tables showing the distances between the seaports of the United States and the principal seaports of the rest of the world.

James E. Simons, formerly assistant master car builder of the Pittsburg & Lake Erie Railroad, is now superintendent of rolling stock and machinery for the Pittsburg Coal Co., the great combination recently organized in Pittsburg. His offices are in the Hussey building at Pittsburg.

New machinery to the amount of $1,475 has recently been secured for the engineering shops of the University of Michigan.

DEATH OF GEN. THOMAS W. HYDE.

Gen. Thomas W. Hyde, founder of and principal stockholder in the Bath Iron Works, Bath, Me., died on the 13th inst. at Old Point Comfort. Va. He had gone to Virginia six weeks before hoping that a change of climate might prove beneficial to his health, which was then fast failing. He had been an invalid for upwards of two years.



Gen. Hyde was born in Florence, Italy, in 1841. He graduated in succession from the Bath High School, Bowdoin College and Chicago University. His record during the civil war was a most remarkable one and highly creditable. He organized a company of the Maine regiment, of which he was elected major and in the absence of his superior officers took the regiment to the front in August, 1861. At the close of the war he returned to Bath and acquired the foundry which was henceforth operated under his name, manufacturing windlasses, pumps, capstans and other ship machinery. His next move was the acquisition of the Goss Marine Iron Works, where, from that time forward, marine engines and other machinery was constructed. Then ship building was taken up, and in 1889 Gen. Hyde secured the contract for the crusiers Machias and Castine. Since that time the Bath Iron Works has been continuously engaged in building vessels and has turned out many prominent naval and mercantile vessels. Gen. Hyde some years ago organized the Hyde Windlass Co., to which was turned over the manufacture of all the forms of auxiliary machinery in which he had an interest. He was prominent in many public organizations and had been for years a member of the council of the Society of Naval Architects and Marine Engineers. He is survived by several children. His sons have for some time past been in charge of business affairs at Bath.

THE AMERICAN NAVY.

From the annual report of Rear Admiral Philip Hichborn, chief of the bureau of construction and repair, navy department, it appears that the present naval strength of the country is 303 vessels, of which 215 are in the regular and 88 in the auxiliary navy. The vessels of the regular navy are apportioned as follows: Twelve first-class battleships; three first-class battleships, sheathed; one second-class battleship; two armored cruisers; three armored cruisers, sheathed; one armored ram; four steel single-turret monitors; six double-turreted monitors; nine iron single-turret monitors; thirteen protected cruisers; eight protected cruisers, sheathed; four unprotected cruisers; twelve gunboats; three light-draught gunboats; six composite gunboats; one training ship (naval academy); two special class vessels; nineteen gunboats under 500 tons; sixteen torpedo boat destroyers; thirty-six steel torpedo boats; one submarine torpedo boat; one wooden torpedo boat; five iron cruising vessels; seven wooden cruising vessels; six wooden sailing vessels; seventeen tugs; eleven wooden steam vessels unfit for sea service; and six sailing vessels unfit for sea service. In the auxiliary fleet are seven merchant vessels converted into auxiliary cruisers; twenty-five converted yachts; twenty-seven converted tugs; seventeen steamers converted into colliers, and twelve special class vessels.

All of the vessels purchased by the war department or captured from Spain are included in the lists, but the particulars regarding them are meagre in the extreme. Details regarding the converted vessels and the special class craft, which were incomplete in last year's report, are, however, presented in very complete form. During the year which has intervened since the compilation of the last report the navy department has accepted from the builders after official trials fifteen new vessels; four sunken Spanish vessels were raised and added to the navy and seventeen vessels were added through purchase or capture on the Asiatic station. Of the forty vessels which were dropped from the navy department, the greater portion were either revenue cutters which were returned to the treasury department or auxiliary craft which were sold. Within the twelve months covered by the report fifty-two vessels were surveyed for repairs and in a number of instances the same vessel was surveyed two and even three times.

RESULTS OF THE PERSONNEL BILL.

The results of the personnel bill upon the engineer corps of the navy are precisely what we predicted they would be at the time of its passage, but it is somewhat surprising to find so experienced an officer as Admiral Melville expressing surprise that officers of the line do not take more kindly to engineering work. Who expected that they would? The fact is not to be disguised that the navy no longer has an engineer corps, and must wait for one until they can make one out of the warrant machinists, who will make an appeal to congress next winter for commissions. They and other enlisted men are doing the duty in the engine rooms formerly assigned to officers of the engineer corps, who are no longer required to stand watch over the engines. A reference to the annual report of Admiral Melville will show that he has called the attention of the department to this serious blow at the efficiency of the navy. He is too late; the mischief is done, and there is but one remedy, which is to create a new engineer corps. We shall have more captains, commanders and so on, but no more engineers of the type that has made our navy so efficient in their department; that is not until we can evolve a new engineer corps.—Army & Navy Journal.

DECISIONS IN COLLISION CASES OF LONG STANDING.

The collision between the steamers Conemaugh and New York, which occurred in the Detroit river near Sandwich, Ont., Oct. 21, 1891, has been finally determined by the United States supreme court, both vessels being held in fault. The experience of this case has been somewhat varied. In the district court, first both vessels were held at fault. On petition for rehearing, in view of a then recent decision of the United States supreme court, the district judge modified his finding and held the New York solely at fault. The case was appealed and the United States court of appeals for the sixth circuit reversed the district court and held the Conemaugh solely at fault. Ordinarily this would have been the final determination. Petition for rehearing was filed in the United States court of appeals on behalf of the Conemaugh, but rehearing was denied. Application was then made to the United States supreme court for writ certiorari, which was granted, on the ground that there were questions involved in the case which were of great general importance, and as to which there was error in the decision of the circuit court of appeals. The case was fully argued in the supreme court and in an opinion handed down Monday of this week both steamers are again held in fault.

The questions submitted to the court, aside from the matter of fault as between the two vessels, call for determination of the character of the great lakes, whether they are high seas or not, within the meaning of the act of 1885 establishing sailing regulations (the international code), and as to whether the United States or Canadian sailing rules are applicable to United States vessels when meeting in Canadian waters on the great lakes. The opinion of the court will probably be obtained in time for publication in the next issue of the Review. The New York was represented in the supreme court by C. E. Kremer of Chicago and H. C. Wisner of Detroit, and the Conemaugh by Messrs. Goulder and Masten of Cleveland and F. H. Canfield of Detroit.

The case growing out of the collision between the steamers Waldo and Choctaw at the Sault, May 20, 1896, has been argued before the United States circuit court of appeals for the sixth circuit and is now pending decision.

CLAIMING NO CONCLUSION IN THE CARTER CASE.

In its last issue the Engineering Record of New York prints the text of ex-Senator George F. Edmunds' review for the secretary of war of the whole record of the proceedings of the court-martial which tried Capt. O. M. Carter of the army engineering corps. After this review was made, the president, acting on the advice of Attorney-General Griggs, approved the finding of the court. Following the text of Mr. Edmunds' review there is printed a table of the charges and specifications on which the court-martial judged the accused officer guilty, and the decision of Mr. Edmunds and the attorney-general on each are placed side by side. The review of the case by Mr. Edmunds and the surprising difference of opinion shown by the table as to whether the accused officer was guilty or not guilty of the different specifications in the several charges prompts the Engineering Record to declare that the guilt of Capt. Carter has yet to be proved, and that no time should be lost in bringing the civil action against his alleged fellow-conspirators, so that the case may be tried according to the usual methods of legal procedure. The Record is not willing to accept the doctrine that because the members of this court-martial were individually honest, able and distinguished, a majority of them could not be mistaken in all their findings. The records of court-martial proceedings, it is claimed, justify no such conclusion.

TRIBUTE TO CHARLES H. CRAMP.

It is gratifying to note that side by side with their recognition of the competition by which American ship builders and manufacturers of ship building machinery are forcing themselves to the attention of their rivals on the other side of the Atlantic, the British trade journals acknowledge the genius of the men who are making ship building in the United States the prosperous and growing industry that it is. In its current issue Syren and Shipping, a London contemporary, has the following:

"Exactly the position held by Mr. C. H. Cramp in the ship building world of the United States, is a question which can be better answered by the American cousin than by us on this side. It is, however, certain that so far as the shipping community of Great Britain is concerned, the name they know best in American ship building is Charles H. Cramp, and the representative American yard to them is that of the William Cramp & Sons Ship and Engine Building Co. of Philadelphia. There are many reasons for this. From the point of view of the student of mercantile marine affairs, American ship building is represented by those magnificent ocean greyhounds, the St. Paul and St. Louis, built by the Cramps. The successors of these ships is only a matter of time. Sooner or later our young relations on the other side of the "herring pond," will secure that shipping legislation they desire, and then the industry will flourish as American manufactures have flourished in every other direction. When the longed-for act of legislature is secured, and the credit therefor comes to be apportioned a huge slice will fall to the share of our "headlight," for, if one man more than another has preached the gospel of American ship building, that man is Charles H. Cramp. Whilst Mr. Cramp is known on this side chiefly, perhaps, as the designer of the two "Saints" of the American line, the fame of his company as designers and builders of warships is deserving of even greater prominence. The Cramps have built many men-o'-war of all shapes and sizes, and, true to his character, Mr. C. H. Cramp has introduced many new ideas into them. The splendid passage of the triple-screw cruiser Columbia across the Atlantic is still remembered. Besides fighting ships for the navy of his own country, Mr. Cramp has been entrusted with orders from foreign nations, thus leading the van in that competition with European ship builders which he maintains will become of ever-growing importance. He may be right or wrong, but it is perhaps fortunate for ship builders on this side of the Atlantic that America possesses only one Charles H. Cramp.

Mr. E. W. Oglebay of Oglebay, Norton & Co., Cleveland, has returned from a European trip.

NEWS OF THE SHIP YARDS.

The Western Steam Navigation Co., known as the Vancouver line, has placed a contract with F. M. Crawford, ship builder of Tacoma, Wash., for a new steamer for service between Tacoma and Vancouver. The vessel will be modeled on the lines of the steamer Kingston, and will be 162 feet in length, 28 feet beam and 12 feet depth of hold. She will have two Scotch boilers, triple expansion engines, an electric light plant and modern auxiliary machinery. A speed of 15 miles an hour is guaranteed for all kinds of weather. Accommodations will be provided for seventy-five first-class passengers. The vessel will cost when completed $60,000.

Numerous, and in some instances conflicting, reports have been circulated during the past few weeks relative to a projected consolidation of five or six of the principal ship yards on the Atlantic and Pacific coasts. That such a move is on foot is admitted. The firm of J. & W. Seligman & Co. of 21 Broad street, New York City, which holds considerable stock in the Wm. Cramp & Sons Co., is engineering the deal. Charles J. Canada of New York, who is looking after the option part of the promotion, says that it will be some time before anything definite relative to options can be given out.

The four-masted schooner Mary W. Bowen, building for Capt. Whitman Chase, Jr., of Taunton, Mass., is rapidly approaching completion at the New England Co.'s yard, Bath, Me. She will be launched in two weeks. The New England Co. has just closed the contract for the construction of a four-masted schooner of the following dimensions: Length, 165 feet; beam, 37 feet; depth, 17 feet; tonnage, 1,000.

A 6000-ton steel freight steamer, building at the Wyandotte yard of the Detroit Ship Building Co., for Senator James McMillan, Mr. A. McVittie and others of Detroit, was launched on Saturday last. This steamer has not been named as yet. She will, of course, be ready to begin service on the opening of navigation next spring. She is chartered to carry ore during the entire season at $1.25 a ton from Duluth.

The Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, of Morris Heights, New York City, has issued invitations to the launching of the United States torpedo boat Bailey, which will take place Tuesday noon, Dec. 5. Guests will be conveyed to the yard by a special train on the New York Central Railroad.

The Craig Ship Building Co. of Toledo will rebuild the steel steamer Harlem, a vessel of about 3,000 tons capacity, which spent all of last winter and the greater part of the present navigation season ashore on Isle Royale, Lake Superior. Repairs to this vessel will probably approximate $100,000.

The Barnett-Record Co. has completed the excavation for the new dry dock to be constructed at the plant of the Superior Ship Building Co., West Superior, Wis. Excavation work on the large new dock building by Capt. James Davidson at West Bay City, Mich., is also nearing completion.

Mozena Bros. of Clarington, O., are building a river steamer to take the place of the steamer LeRoy. The new boat will be 168 feet length and 34 feet beam and will be equipped with two engines of 16 inches diameter and 6 feet stroke.

O'Brien & Oulihan of Syracuse, N. Y., have secured the contract for the erection of the steam engineering shops at the Brooklyn navy yard. Their bid was $331,000. They are required to complete the work within ten months.

Bidders for the construction of the government steel steam light-vessel, No. 73, were the Pusey & Jones Co., Wilmington, Del., $119,221; the Spedden Ship Building Co., Baltimore, Md., $89,437; the latter being accepted.

J. P. Devney of Ashtabula Harbor, O., is building for Richardson Bros. of the same place, a wooden fishing tug of 76 feet over-all length, 16½ feet beam and 6 feet moulded depth. She will have a 14x16-inch engine, built at the machine shop of the Harbor Ship Chandlery. Mr. Devney will also build for Huron, Ohio, parties a wooden tug of 80 feet over-all length, 17 feet beam and 6½ feet moulded depth. The size of engine for this latter boat has not been decided upon as yet.

Percy & Small, wood ship builders of Bath, Me., have leased the John McDonald ship yard, recently purchased by G. G. Deering, and will build a six-masted schooner with a carrying capacity of 5,000 tons, which is equal to that of the large steel shipentine Edward Sewall.

George L. Welt of Waldoboro, Mass., will build a five-masted schooner for William F. Palmer of Dorchester, Mass. The new vessel will be 280 feet over all, 240 feet keel, 46 feet beam and 25 feet deep. She will have three full decks.

An auxiliary schooner yacht, 57 feet in length and fitted with a 16 horse power gasoline engine, is being constructed for Homer Skinner by Read Bros. of Fall River, Mass. The engine will be furnished by Murray & Tregurtha of South Boston, Mass.

It is reported that Capt. James Hawley has rented the Houghton Bros. ship yard at Bath, Me., and will build a four-masted schooner of 1,600 tons.

A report from Pittsburg is to the effect that the recently organized Pittsburg, Cincinnati & Louisville Transportation Co. will build two new steamers.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of Nov. 22, 1899.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire	48⅞	49	48¼	48⅝
American Steel & Wire, Pfd	......	......	......	......
Federal Steel	58⅜	58¾	58	58½
Federal Steel, Pfd	80¾	80¾	80⅜	80⅜
National Steel	......	......	......	......
National Steel, Pfd	95	......	......	95
American Tin Plate	34¼	34½	34¼	34½
American Tin Plate, Pfd	84	84	83½	83½
American Steel Hoop	45¾	46	45	45¼
American Steel Hoop, Pfd	82½	......	......	82½
Republic Iron & Steel	24¾	24⅞	24⅝	24⅞
Republic Iron & Steel, Pfd	......	......	......	......

LIVERPOOL'S GREAT DOCKS.

Liverpool provides for its shipping by the most ample, elaborate and perfect system of harbor accommodation the world has ever seen; indeed, there is nothing that faintly resembles it anywhere else. And, wonderful as these docks are, there is nothing final about them, as they are constantly being reconstructed to meet all the requirements of present-day ships. But the real problem before Liverpool is not how rivals are to be kept off and "bested," but how the new questions raised by the progress of the science of ship building are to be met and solved successfully. Immense vessels of the 600 to 700 foot kind now building predicate a dry dock a thousand feet long. Liverpool has already one, the biggest in the world, 950 feet long, and another is being built at the present moment that will be fully 1,000 feet in length. When we remember that the first dock of Liverpool was built nearly two hundred years ago, and what the size of the biggest ship was at that time, it will very easily be understood that the older portions of the Liverpool system consist of small, narrow docks, while those more recently constructed are large and commodious. There are rather more than a hundred wet and dry docks, tidal basins and connecting locks, all strung along the seven or eight miles of the Liverpool shore of the Mersey. The smallest dock is not much more than an acre in water area, but the largest, the Alexandra dock, with its three branches, covers upwards of thirty-three acres. The total water area of the Liverpool system is more than 385 acres, affording a quay space of over twenty-five miles.

LAWRENCE IS 64 PER CENT. FINISHED.

Editor Marine Review:—On page 15 of your issue of Nov. 16, in giving Rear Admiral Hichborn's statement as to the progress of work upon the various vessels now under construction for the navy, you say that the torpedo boat destroyer Lawrence, Fore River Engine Co., is 27 per cent finished. This should be 64 per cent. It is so large an error and places us so near the foot when we are really at the head that we ask you to kindly make the correction in your next issue.

Weymouth, Mass., Nov. 20, 1899. FORE RIVER ENGINE CO.

The Phenix Metallic Packing Co. of 177 La Salle street, Chicago, manufacturers of metallic packing and an automatic lubricating pump, report orders within the past few days for metallic packing from the Plano Mnfg. Co., Union Elevated Loop Railroad, Western Electric Co., Evanston Electric Light Co., Otis Elevator Co., and for all the engines in the new building of the telephone company, Chicago. Orders for lubricator pumps include five for the Madison (Ill.) Coal Co. and one for W. D. Allen & Co. Air pump packing orders are recorded from the Central Railroad of New Jersey, Chicago & Rock Island, Delaware, Lackawanna & Western, Delaware & Hudson and Baltimore & Ohio. The Standard Oil Co. has also placed a large order for Phenix metallic packing.

ENGLISH VIEW OF OUR MERCHANT MARINE.

BRIEF EXTRACTS FROM AN EDITORIAL ARTICLE APPEARING IN THE ENGINEER OF LONDON, OCTOBER 27, 1899.

"The wholesale withdrawal of steamers from the Atlantic trade for transport purposes, and the conseauent rise in freights, are bringing the United States to a proper realization of the inadequacy of its mercantile marine in relation to the foreign trade of the country."

"The gross capacity of the American vessels available for ocean traffic today does not exceed 300,000 tons out of an aggregate of 2,300,000 tons, while England possesses close upon 13,000,000 tons. The proportion of American trade carried in American vessels, on the basis of value, was 12 per cent in the last fiscal year, whereas forty years ago is was 66 per cent. At that time American ships not only took a good share in their own country's foreign commerce, but were serious rivals to English ships in English trade with countries other than the United States."

"Now, American ships are virtually unknown in the trade between neutral countries, and out of about 24,500,000 tons of shipping clearing from American ports in the course of a year not much more than one-fifth flies the stars and stripes; and, as showing incidentally how much of American loss in this respect has been Great Britain's gain, it may be stated that out of 18,000,000 tons of exclusively foreign shipping cleared, 12 000,000 are English. We have secured a similar preponderance in other markets."

"'Free ships' would be a good thing for English ship builders, for whether at first or at second hand, the vessels purchased would of necessity be of English build for the most part, but they would hardly be a good thing for English ship owners, for a new element of competition would be introduced. The development of a native American ship building industry can be of advantage to neither builders nor owners here."

Thanksgiving day rates via the Nickel Plate road are available Nov. 29 and 30, good returning until Dec. 1, inclusive, at one and one-third fare for the round trip within a radius of 150 miles. A Peerless trio of daily express trains. 166, Nov. 30

Ohio and Indiana game law—From Nov. 9 to Dec. 1, inclusive, excursion tickets for parties of three or more traveling together on one ticket at one fare for the round trip will be sold to points in western Ohio and Indiana on the Nickel Plate road. The immense quantities of small game along the line of the Nickel Plate road affords rare enjoyment to the sportsman. 168, Nov. 30

U. S. Engineer Office, Milwaukee, Wis., Nov. 14, 1899. Sealed proposals for building Crib Breakwater at Sheboygan Harbor, Wis., will be received here until 12 o'clock noon, standard time, Dec. 14, 1899, and then publicly opened. Information furnished on application. J. G. Warren, Capt., Engrs.
Dec. 7.

U. S. Engineer Office, 1637 Indiana Ave., Chicago, November 2, 1899. Sealed proposals in triplicate for constructing three miles or less of Feeder of Illinois & Mississippi Canal, from mile 9 to 11, inclusive, near Tampico, Ill., will be received here until 12 noon, central time, December 2, 1899, and then publicly opened. Information furnished on application here, or to Assistant Engineer L. L. Wheeler, Sterling, Ill. W. L. Marshall, Maj., Engineers. Nov. 23.

U. S. Engineer Office, Montgomery, Ala., October 20th, 1899. Sealed proposals for building a sea-going hydraulic dredge will be received here until 12:00 M., November 22d, 1899, and then publicly opened. Information furnished on application. C. A. F. FLAGLER, Capt., Eng'rs. Nov. 23